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The Role of Higher Education on Economic Growth in Ethiopia

Kidist Ibrie Yasin

A Thesis Submitted to
The Department of Economics

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Science in Economics

(Economic Policy Analysis)

Addis Ababa University

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School Of Graduate Studies

This is to certify that the thesis prepared by Kidist Ibrie, entitled: *The Role of Higher Education on Economic Growth in Ethiopia* and submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Economics (Economic Policy Analysis) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Chair of Department or Graduate Program Coordinator

ABSTRACT

The Role of Higher Education on Economic Growth in Ethiopia

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Addis Ababa University, 2012

There is no study that has explicitly shown higher education's role to economic growth in Ethiopia; neither its contribution to output growth in general nor the relative importance of the two major streams -social science and natural science- in particular. With the objective of assessing the role of higher education to economic growth and identify the relatively more important stream, either social science or natural science, the study examines the role of higher education graduates to output growth in Ethiopia for the period 1980-2011. It splits total graduates into social and natural science streams to examine their relative significance to output growth in the country. Thus, three growth equations are estimated using long-run (co-integration) and short-run (error correction) methods. Proxies to human capital in each of the three growth equation are total graduates, social science graduates and natural science graduates respectively. The study finds positive and significant effect of total graduates in output growth both in the long run and shortrun periods. It also finds a positive and significant coefficient for both of the streams in the long and shortrun periods. Moreover, the coefficient of social science is relatively higher than the natural science. Hence, this study recommend the government to invest more on higher education since graduates are positively and significantly affecting economic growth of the country. However, the current priority to natural science stream in Ethiopia is questionable and needs further investigation.

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List of Acronyms

ADF - Augmented Dickey-Fuller

AIC - Akaike Information Criterion

BD - Government Budget Deficit

CGE - Computable General Equilibrium

CPI - Consumer Price Index

ECM - Error Correction Model

EPDRF – Ethiopian People's Revolutionary Democratic Front

ERP - Economic Reform Program

GFCF - Gross Fixed Capital Formation

GoE- Government of Ethiopia

GRLF - Growth Rate of Total Labor Force

HEIs - Higher education Institutions

HERQA - Higher Education Relevance and Quality Agency

HUM - Human Capital,

MA - Moving average

MoE - Ministry of Education

NMA - National Meteorological Agency

OLS - Ordinary Least Square

OPN - Openness of the Economy

RGDP -Real Gross Domestic Product

SAP - Structural Adjustment Program

WB- World Bank

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Human capital is defined as the attributes of a person that are productive in economic context. It often refers to formal educational attainment, with the implication that education is investment whose returns are in the form of wage, salary, or other compensation. These are normally measured and conceived of as private returns to the individual (William, 2004).

Recently. global wealth is concentrated less in factories, land, tools and machineries. Instead the knowledge and skill of people is critical to the world economy. For instance in United States it is estimated that human capital is three times more important than physical capital (David et al, 2005).

The return to primary, secondary and tertiary education is not studied well. Without analyzing the returns, attention has focused on primary and secondary education during the past two decade. This has led to a neglect of tertiary education especially in developing countries. With a few notable exceptions, it is underfunded by governments and donors. As a result, quality is low and often deteriorating, while access remains limited. This situation is most prevalent in Africa where the education sector is at its lower stage. (David et al, 2005).

As Peirl, et al. (2000) states, the tertiary education sector in Africa is not as efficient as it is assumed to be. They explained that cultural traditions and infrastructure limitations also frequently cause students to study subjects, such as humanities and the arts that offer limited job opportunities and lead to "educated unemployment." At the same time, there is often unmet demand for qualified science graduates while in many societies women study subjects that conform to their traditional roles, rather than courses that will maximize their opportunities in the labor market. These are the characteristics of most African countries where Ethiopia is one of them, (Peirl et al , 2000).

Higher Education in Ethiopia includes institutions that are giving the three, four or more years of undergraduate programs, as well as those offering postgraduate programs (masters and PhD). Ethiopian higher education has been started a little over 60 years ago. As Teshome (2003) noted it out, until few years back, the tertiary level enrolments were very low (about 5% of the age cohort) and were one of the lowest in the world. However, since 2011, there exist twenty two public universities including the following four institutions; Ethiopian Civil Service University, Defense University College, Telecommunication and Information Technology College, and Kotebe College of Teachers Education (degree program) and around 70 non-governmental accredited higher institutions (MoE 2010/11). These institutions annually graduate thousands of students that are supposed to foster economic growth in the country with the assumption that human capital in education enhances growth.

This study helps policy makers understand the relationship between the number of graduates and economic growth at macroeconomic level.

1.2 Statement of the problem

Ethiopia is one of the poorest nations, who experienced unsatisfactory economic performance for centuries. As of Seid (2000), in the past three and half decades the economy grew by 3.1% while population grew by 2.6% offsetting the rate of economic growth of the country. However, recently, there is a dramatic growth rate of Real Gross Domestic Product (RGDP) especially since 2004. For instance, RGDP for the year 2007 was close to 14 billion US dollars with annual growth of 11% - impressive performance compared with the year 1997 when it was only around 7.5 billion US dollars with just 3% annual growth rate.

The Government of Ethiopia (GoE) has been active in this growth process. Even if attention is due mainly to market forces, the widespread market imperfections and institutional constraints necessitate active role from the government especially in some sectors. Education is the critical sector that the government has actively engaged in and promoting to develop the human capital level in the country. The primary, secondary and tertiary education levels have shown a striking increase since 1991 when the Ethiopian People's Revolutionary Democratic Front (EPDRF) took power. The current government is giving high emphasis to higher education institutions through enhancing the capacity of the existing universities and extending the number of universities by opening new ones all over the regions. This effort aims mainly to produce competent, adaptable and responsible citizen who can contribute to changing and transforming the livelihood of the country. Moreover, the government establishes an institution called Higher Education Relevance and Quality Agency (HERQA) so as to assure and develop the quality of the sector and produce graduates who are capable to transform the economy to a high standard (MoE, 2010/11).

This expansion assumes that human capital in the form of education has a positive and significant effect on economic growth. However, evidences for this assumption are weak. Some argue that at micro level more years of schooling lead to higher income. But at macroeconomic level the effect of more schooling to economic growth is far from being obvious (David et al, 2005). In this respect Wubet (2006) examines the impact of human capital on economic growth in Ethiopia through application of error correction methodology. He found that the human capital variable in the form of schooling, in general, has an insignificant impact on the level of output. However, no study has ever explicitly shown higher education's role to economic growth in Ethiopia; neither its contribution to output growth in general nor the relative importance of the two major streams -social science and natural science- in particular. Therefore, this study fills the gap by analyzing the issue in Ethiopia using time-series data from 1980 to 2011.

1.3 Objectives of the Study

1.3.1 General objective

The general objective of this study is to assess the role of higher education to economic gowth and identify relatively more important field of study (either natural science or social science) in Ethiopia.

1.3.2 Specific objectives

To achieve the general objective, the study addresses the following specific objectives that include:

- to review the major educational development in the country;
- to analyze the effect of higher education on output growth using time series analysis;
- to examine the relative contribution to output growth of higher education graduates from social and natural science streams;
- to derive policy implication based on the result found.

1.4 Significance of the Study

The development of higher education can contributes a lot to economic development in any country. The East Asians are the major evidence for this justification (Lin, 2004). But in Ethiopia the role of higher education on economic development is among the untapped area of study. Besides the effects of each graduates from natural sciences and social science streams is different. But which felid is relatively important in Ethiopia? This is the question we should ask before formulating higher education policies. Hence, the most important significance of the paper is for the policy makers since it allows them to revise higher educational policies based on the findings of this study. In addition, it sets a base for further analyses on the topic thereby filling information gap in the area.

1.5 Data source and Methodology

The study used time series analysis so as to analyze the contribution of higher education to economic growth in Ethiopia. It basically follows Lin's (2004) method in which time series analysis is employed in order to explore the role of higher education on the economic development of Taiwan. But he uses only labor and capital as the determinants of growth. To account for any possibility of omission of relevant variables in the model, this study considers additional variables. Among others, foreign aid, government budget deficit, openness, rainfall, inflation and economic policy are selected as a main determinant of growth in addition to labor and capital. This methodology also helps to examine which stream graduates-social or natural science-is relatively more important in Ethiopia by comparing the coefficients of the two streams in the regression equation. Simple interpolation technique is used to generate social and natural science graduates data from 1981-1995 and 1997-1999 because of absence of non-interpolated data until the analysis for this study is completed. In addition to the econometric analysis, qualitative and quantitative descriptive methods are also used to analyze historical trend and policy issues of education in Ethiopia.

The major secondary data sources are World Bank (WB), National Meteorological Agency (NMA) and Ministry of Education (MoE).

1.6 Scope and Limitation of the Study

This study focuses on the role of higher education in economic development of Ethiopia through its effect on output. To achieve this objective, growth equation of Ethiopia is estimated for period 1980 to 2011. In the estimated growth equation, the variable human capital is proxied by the number of graduates from higher education. Graduates in this study are defined from the standard definition of MoE. According to the definition "graduates are those who complete their study at the higher education institutions, from, undergraduate degree, postgraduate masters, or postgraduate PhD programs." The study considers graduate from all fields in each stream and graduated in different programs-regular, summer, extension and distance- as well as different level-first degree, masters and PhD as assumed to be homogenous. Perhaps the first two may be justified[1] but the third assumption is, admittedly, strong. To simplify the analysis and due to the presence of other factors such as brain drain[2], any possible heterogeneity from masters and PhD graduates is assumed to be nullified.

For a limited number of years data on social science and natural science streams is interpolated from the total graduates based on the average graduates of the two

[1] Until very recently the higher proportion of graduates are in education and agricultural fields where significant differences have not been discovered. Moreover, there is a tendency for graduates to be employed not on the basis of their fields of study but on the level of their degree. With the exception of distance education graduates that constitute a tiny portion of the pie, there is no evidence of systematic difference between graduates from regular, summer and extension programs.

[2] In Ethiopia and many other developing countries brain drain is most prevalent especially among graduates in second and third degrees. It implies lose of skilled manpower and, on average, lower value of a graduate in these levels.

streams calculated from the other years. Thus, results could be subject to econometric issues related to data interpolation.

In the study, the contribution to economic development of higher education graduate is investigated through its impact on output. However, economic growth is a broader concept and the link between a graduate and economic growth may not only be output.

The study considers total, social science and natural science stream higher education graduates in general. And the conclusion from this study may not necessarily be valid for specific fields in each stream. Thus, further investigation should be undertaken using reliable time-series data and sufficient time of researcher.

1.7 Organization of the Paper

This study has six chapters. The first chapter is an introductory part of the study. In the second chapter, theoretical issues and empirical studies are reviewed. The third chapter, in a descriptive way, discusses history of education, status of higher education, output growth, and the current higher education policy in Ethiopia. In the fourth chapter, the model specification and methodological framework of the study are presented. The fifth chapter is devoted to the discussion of the results from the empirical analysis. Chapter six concludes and identifies the policy implication of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Literature

This section reviews different theories of human capital. Specifically, history of human capital theory, human capital theories and education, major theories in modeling human capital and the effects of government policies on human capital are reviewed.

2.1.1 History of human capital theories

Dictionaries define Human capital as the stock of competencies, knowledge and personality attributes embodied in the ability to perform labor so as to produce economic value. Human capital theories imply that individuals and society derive economic benefits from investment in people. This idea of human capital is not a current issue but dates back to the 17th century. Around 1691, Sir William Petty placed a value on laborers, estimated the value of human capital to demonstrate the power of England and estimated the cost of life lost in war and other deaths. There were also other early contributors to the human capital theories by suggesting in various ways that human beings are an investment which generates a return. Among them were Adam Smith (1776), Jean Baptiste Say (1821), John Stuart Mill (1909), William Roscher (1878) and Henry Sidgwick (1901). Many other early researchers recognized the concept of human capital but refused to consider people as physical commodities due to "sentimentalism." Although human capital theory properly evolved in this century, its basic conceptualization was expressed centuries ago (Kiker et al, 1997).

Adam Smith (1776) explains human capital as the acquired and useful abilities of all the inhabitants or members of the society. He argues that the acquisition of such talents always costs a real expense which is a fixed capital and realized in the person. Those talents that make part of the person's fortune will also benefit the society to which he belongs. The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade facilitate labor. Even though it costs a certain expanse, but it repays that expense with a profit. For Smith "The greatest improvement in the productive powers of labor, and the greater part of the skill, dexterity, and judgment with which it is any where directed, or applied, seem to have been the effects of the division of labor". Ricardo, Malthus, and Mill, all supported the extension of education. However, smith's successors did not get deep into the problem as their school founding predecessor. Additionally he explained a complicated relationship between human capital and division of labor.

Alfred Marshall (1890) took up smith's theory and went further. He states as ". . . the most valuable of all capital is that invested in human beings". Acknowledging the views of Smith, Marshall (1890) centered his economic discussions of human capabilities on the premise that they are agents of productive wealth. However, Marshall empirically discharged the inclusion of human capital in the market mechanism because it lacked a market exchange for determining value.

The need for the incorporation of human capital in economic analysis become apparent in 1950's and 1960's because of empirical research findings. One of the major finding was the growth of output in U.S. was much higher than the growth rate of measured inputs of labor and capital in the country which contradicts growth is a function of labor and physical capital only. The other finding was the variation of labor income rather than functional difference between returns to labor and to capital showed a personal income inequality. Hence as Mincer (1974) describe it well the development of human capital helps to simplify the assumption in the restriction of the concept of capital to physical capital only and the assumption of homogenous labor.

2.1.2 Theories of human capital and Education

Current interest in the economics of education branches from theories of economic growth and development. The discovery that increases in only physical capital and labor did not, by themselves, explain economic growth led to an analysis of the factors determining the "residual"; in particular, the role of education and technical knowledge (Woubet, 2007). According to human capital theory developed by Schultz (1961) and Becker (1964), education enhances a person's skill level and thereby his or her human capital. A higher skill level in the workforce increases the production capacity. Even though this seems very simple, methodical research on how to incorporate human capital in theories of growth started only about two decades ago.

According to Jacob et al (2004), Expenditures on education can be interpreted as investments in human capital. Education is an economic good since it is not easily obtainable and it posses the characteristics of both consumer and producer goods. This is because it offers utility to a consumer and also serves as an input into the production of other goods and services. As a capital good, education can be used to develop the human resources necessary for economic and social transformation. The focus on education as a capital good relates to the concept of human capital, which emphasizes that the development of skills is an important factor in production activities. It is generally accepted that education creates improved citizens and helps to develop the standard of living in a society. It augments individual human capital and leads to a greater output for society and enhanced earning for the individual worker as well. It increases the chances of employment in the labor market, and allows reaping pecuniary and non pecuniary returns and gives opportunities for job mobility, (Patrick, 2011). But Heckman (2000) states that post-schooling learning is an important source of human capital formation accounting as much as one third to one half of all skill formation in a modern economy.

The human capital theories argue that an educated population is a productive population. In the works of Schutlz (1971), Psacharopouls and Woodhal (1997) formal education is highly instrumental and necessary to enhance the production capacity of a given population. Education also affects percapita income growth through its impact on the denominator (population growth). Studies show that negative correlation between female schooling and fertility in most countries, (Patrick, 2011).

As of Bronchi (2003) Education is helpful in the development of a general trend favorable to economic progress in reference to social mobility and increase in literacy is helpful for improved communication. In addition educated people would be more adaptable to varying production needs. Moreover, education has greater durability than most of non- human reproducible capital which shows investment in education is more productive.

To put it in a general way, there are vast literatures on the benefits of education. The entire theory of human capital centered on the assumption that investment in education do in fact translate into higher workers productivity. The literature in human capital theory distinguishes several types of means of education. These are formalized education in primary, secondary and higher levels, Schutlz (1981) also identify informal education at home and work in addition, Mincer (1974) discuss on the job training and apprenticeships. These studies showed that as the type and means of education differs the benefits acquired from education also differs.

2.1.3. Theories of human capital models

The attempt to explain the impact of education on economic growth can be classified into two groups. These are the Neoclassical Model and the endogenous growth model. But the macroeconomic literature on the returns to education is mainly based upon the Neoclassical Solow's growth model. Mankiw, Romer, and Weil (1992) presented the human capital augmented Solow model of economic growth. They noted that such a model fit the data extremely well. According to their model an output Y can be represented as:

$$Y(t) = K(t)^{\alpha} \; H(t)^{\beta} \; [A(t)L(t)]^{1-\alpha-\beta}$$

where α is the share of capital, β is the share of human capital and t denotes time. α and β ϵ [0; 1], They assume the equation is the production function which exhibits constant returns to scale in its three factors: physical capital (K), human capital (H), and productivity-augmented labor (AL). Specifically, it is a Cobb-Douglas production function. All markets (both input and output markets) are assumed to be perfectly competitive. All firms are assumed to be identical. Physical capital and human capital are assumed to be accumulating factors; i.e., their equations are:

$$K\ (t) = skY(t) - K\delta(t)$$

$$H\ (t) = shY\ (t) - \delta H(t)$$

where sk and sh are the saving rates for physical capital and human capital respectively. They are exogenously given. The rate of human capital accumulation can affect the steady-state level of output per effective worker. From their finding the addition of human capital to the model allows for another dimension to be cited in explaining difference in output levels across countries. Countries who invest in education are predicted to have higher income levels than those who do not for any given investment rate in physical capital.

The other model that helps to measure the impact of human capital on economic growth is the Endogenous growth model. To Rebelo, the production function is linear in the only input, capital. Hence there are constant returns to scale and constant returns to capital.

The production function is formulated as:

$$\mathbf{Y = F\ (L, K) = AK}$$

where A is an exogenous constant and K is aggregate capital. So that K can include not just physical capital but also human capital as well as the stock of knowledge and even financial capital.

But the other endogenous growth theorist, Lucas, chooses to introduce an externality in human capital. Let ha be the average level of human capital in the labor force. Then wcan production function is written as:

$$Y = Ak^{\beta}(uh)^{1-\beta}ha^{\psi}$$

where ha Represents the externality from average human capital. This externality is introduced, not to obtain endogenous growth but to obtain some extra results on migration across countries. In any event, agents choose to maximize the standard inter-temporal utility function subject to the capital accumulation constraint:

$$K = AK^{\beta}(uh)^{1-\beta}ha^{\varphi} - c$$

Lucas tried to show how knowledge is accumulated. Knowledge can be accumulated through when agents learn (time not spend on working) and when agents study and through on job training (time spent on working). He assumed that there is constant returns to scale in human capital accumulation is driving force behind sustained growth in the model. He showed that if the production of human capital improves the growth rate increases so productivity of human capital accumulation affects growth. In a general way for endogenous growth models human capital affects productivity into two ways. The first is higher level of human capital affect productivity directly through its impact on domestic innovation and second higher level of human capital causes improvements in total factor productivity by assisting the adoption and implementation of foreign technology. Technology and human capital are both endogenous to the system.

2.1.4 Effects of government policies on human capital

Governments all over the world intervene in education for various reasons. The basic are for income distribution and efficiency motives. Most importantly in the occurrence of market failure like externalities, capital market constraints, insurance market imperfection and transparency problems, the government highly intervene in the education sector (Patrick, 2011). Different type of market failure requires different types of public intervention. If there are externalities in education sector for example, it calls for government subsidization of education. If there is capital market imperfection, the government can solve it through public provision of loan to students. In addition to efficiency motives equity or income distributional consideration may act as an important additional motivation of government to intervene in education sector. Tinbergen (1975) argued that the government can reduce wage inequality by means of education subsides. This is through increasing enrolment at higher level of education will make low-skilled workers scarce and rise their wage. Whereas the higher supply of educated workers reduces their wage hence education policy reduces wage inequality by lowering the private monetary return to education.

As Patrick (2011) states Government policies can affect education through two channels. The first is through affecting enrolment, that is, a measure of educational quantity and the second is through its impact on educational quality. Educational quantity is usually expressed in enrolment levels or average years of schooling. Educational quality has been traditionally measured by input measures such as teacher-student ratios, teachers' human capital or total public expenditures on education. A more recent strategy, however, is to evaluate educational quality in terms of output indicators measuring the performance of students and graduates. Their performance is measured in test scores in areas like mathematics; reading and science are often used. The quality is measured in the idea that when students in one country outperform students in another country. This is in assuming that they have enjoyed schooling of higher quality, irrespective of whether this higher quality comes from higher teacher-student ratios, the quality of teachers, other expenditures on education or other unobservable factors specific to the production of human capital. Educational policies are also subdivided according to different stages of the education career in which they are carried out. These are during pre-compulsory schooling (or early childhood interventions), compulsory schooling (i.e. primary and secondary education), and post-compulsory schooling i.e. tertiary education.

2.2 Empirical Literature

2.2.1 Worldwide studies

It is hypothesized that education has a positive effect on economic growth. Studies show that, at micro level, more years of schooling lead to higher income of the individual. But at macroeconomics level the effect of more schooling to economic growth is so far being ambiguous. Additionally the results from macroeconomic level were not reliable and difficult to interpret (Devid et al, 2005).

In reviewing theories of human capital it can be found that observing economic growth was not explained by the usual measures that is labor and capital measures. But the quality of labor is an important component of growth too. Mincer (1958) developed a model to investigate the nature and cause of the inequalities in personal incomes. Two types of education (formal and informal) are incorporated in the form of years of education and work experience in his model. He found that as more skill and experience are acquired the earning of individual will increase.

A most comprehensive evidence of the contribution of educational attainment to economic growth comes from the study of Barro and Salai-Martin (1995). They found that educational attainment has significant, positive growth effect. Additionally in the same year they had another study which was more relevant to developing countries. They found a positive educational externality effects on fertility and health. These evidence shows that education has a positive effect on economic growth and has also other positive externalities. But a study by Ruth Judson (1993) shows that it is the allocation of educational investment matters not the level of investment in education. Countries who allocate their educational resource inefficiently will gain little from their investment in human capital. In addition Lant Pritchett (1996) explores that the growth of educational capital per worker has no or even negative impact on the growth of developing countries. He interprets this negative relation as it is due to low quality of schooling, expanding the supply of education in the presence of stagnant demand for educated labor cause the economic return to education to fall rapidly. The other reason is because of institutional set up in these countries, improved skills acquired through education engage in privately remunerative but socially dysfunctional activities so that aggregate output stagnates or even falls.

Simon and Francis (1998) in their study of Human Capital and Economic Development used descriptive analysis so as to compare human capital development in Africa and Asian countries. According to their findings, the percentage of the population over age 15 who had completed primary school in 1990 was 25 per cent in Africa as compared with 32 per cent in South Asia. At the secondary level the gap is larger with only 4 per cent of the population over 15 having completed secondary school. This shows that the level of human capital development in Africa is much lower even from developing countries in Asia. As they try to indicate the role of human capital in Africa's economic development is complex. According to them inadequate investment in education and health are clearly not the only cause of Africa's economic difficulties. However, the poor health and education of Africa's workers is one factor explaining its low income. In general their finding suggests that low level of human capital development in Africa also contributes to its low level of economic development.

To show which level of education brings higher return to a give country, Gemmell (1997) found out that primary level of human capital seems to be relevant for the poorest least developed countries, secondary human capital for intermediate least developed countries, and tertiary human capital for the advanced countries.

Xiujian Peng (2006) investigates the contribution of human capital to economic growth and its potential scope to neutralize the effects of population ageing in China during the first half of the 21st century by using an applied general equilibrium model. The study examined whether the "demographic window" which opened during the 1990s and is projected to stay open until the 2030s can be exploited to inject a growth boost into the economy. According to the paper, such a boost could be achieved through policies of energetic human capital formation and significant government spending on social infrastructure. The study used a Computable General Equilibrium (CGE) model to explore the macroeconomic effects of accelerating human capital accumulation by increasing public expenditure on education. The policy shock raises the output level and real consumption so that it mitigates the erosion of the living standard of the ageing population of China. According to the finding of the paper, Public expenditure on education is welfare enhancing, mitigating the adverse effects of population ageing while providing a respectable environment for China's rapidly increasing elderly population. The paper concluded that, The Chinese government should significantly increase spending on education. This investment should be undertaken without delay because of the long implementation lags of such policies in altering the stock of human capital.

There are lots of studies on the contribution of human capital in the form of education in economic development of a country. But the role of higher education on economic growth in African countries is much limited. Hermannsson (2010), in his study on "The overall economic impact of higher education in Malawi: a CGE analysis of human capital accumulation", presents results from simulating the effective labor supply impacts of Higher education Institutions (HEIs) in Malawi. A CGE model was calibrated for the year 2004. The paper's Result show that given relative price sensitivity of exports and a perfectly effective HE system, in terms of graduation and retention, the long run labor supply impact of current HEIs policy could have a positive 2.8% impact on GDP and 2.2% on employment. But this impact gradually deteriorates as one relaxes assumptions about policy effectiveness. This result shows that one of the three levels of education (from primary, secondary and tertiary) tertiary level education can affect GDP and employment level very significantly. From the study's result, higher education contributes to economic development of Malawi and can tell also about other African countries too.

2.2.2 Studies in Ethiopia

In searching for studies in area of human capital in Ethiopia, there are micro and macro studies. Almost all the micro studies found the positive contribution of human capital to the individual earnings. But the macro results are still ambiguous (some found positive results but others found negative or insignificant results)

Zinash (2000) studied an economic analysis of education, experience and earnings in urban area of Ethiopia. The paper examined the relevance of the human capital approach to explaining the variance in earnings of the household heads using the Mincerian earning function. The paper investigates to what extent that the wage offer to individual is sensitive to productivity of the household. According to the finding of the paper, education proved to be most consistently effective variable in determining earnings of the household heads. This means the higher the level of schooling of the household heads related with higher earnings. This is because a higher education level implies the higher probability to work in a more skill-based job.

In macroeconomic studies, that is, the contribution of human capital on economic growth of the Ethiopia, there are different results found. Among them, Netsanet (1997) found a positive and significant effect on output level using school enrollment as a proxy to human capital level. But Seid (2000) found an insignificant impact in a dynamic model (to show short run effects) using the same school enrollment proxy to human capital.

Woubet (2006) investigates the impact of human capital on economic growth in Ethiopia. He used an error-correction methodology. The study covers the period from 1971 to

2005. He used average number of years of formal education per person among those employed as a proxy to human capital. He followed Barro's method to achieve his objectives. The equation he estimated originates from the augmented neo-classical growth model where they incorporate human capital in the growth equation. The macroeconomic evidence from his study shows that the human capital variable in the form of schooling has an insignificant impact on the level of output. He states the basic reason for his result. It is because of the deteriorating quality of education in the wake of significant expansion in the sector. According to him; schooling might not actually be creating the required skills or raising worker's productivity. In addition in the wake of a stagnant demand for labor, a rise in the supply of educated labor could only lead to a decline in the returns to education. The study also investigates the impacts of the economic policy directions and associated institution settings, which may reduce the contribution of education to growth. As he explained it well, providing more schooling may generate little or nothing to economic growth in the absence of appropriate market and governmental institutions and policies in the labor market. This explains that schooling alone is not a sufficient train to economic growth but should be supported in other institutional developments.

Studies specifically on higher education is much limited in Ethiopia. The following paragraphs reviewed studies only on the higher education.

Abebe (2007) in his study "Quality Assurance in Ethiopian Higher Education" showed the duties and responsibilities of HERQA institution. According to him Quality in Higher Education considers:

i) Input: Resources, Staff profile, Student admission

ii) Process: Teaching, Learning and Assessment processes.

iii) Outcomes: Graduates employability and achievements, research results

As this study explained it well, the effort made by the Government of Ethiopia in expanding HEI and establishing HERQA is commendable. Additionally, the growing number of public and private HEIs need proper accreditation and quality need control mechanism in this respect HERQA should establish link with local and international accrediting institutions.

As of William Saint (2004) in his study, "Higher Education in Ethiopia", analyses higher education reform efforts in Ethiopia. The paper sketches the social context in which higher education is located and described the country's higher education system. The study try to show that in pursuing needed higher education expansion and reform, Ethiopia is seeking to do right things like autonomy, revenue diversification, funding formula, system support agencies. According to him, these reforms face a formidable challenge in that many of them will require substantial changes in the existing institutional culture. In his findings, expenditure per student is very low. There is a substantial shortfall in the number of academic staff available to support the expansion of student in universities. The Quality and Relevance Assurance exists in name only. The descriptive shift from a four-to-a three-year programme intensifies the challenge of maintaining educational quality. All his findings show, the existence of many problems in higher education development in the country.

In the study of Teshome (2004), "the status and challenges of Ethiopian higher education system and its contribution to development", he found that higher education benefits individuals and economy as a whole. In many countries there is a positive correlation between increasing higher education access and economic growth as expressed by increasing per capita income and human capital index. According to the paper the problem in higher education institutions is that they do not research and contribute for its refinement and successful implementation. He explained that higher education in Ethiopia was not earnestly and fully participating in the development efforts of the country. With their outdated orientation and worn out traditions, higher education institution in Ethiopia have deprived the country's opportunity of development.

As of the researcher's knowledge and from the empirical review it can be understood that the impact of specifically higher education on output growth is not studied well in Ethiopia. This study can contribute to fill the information gap in this area.

CHAPTER THREE

EDUCATION IN ETHIOPIA

3.1 Historical Background and Trend

The economic as well as social development of a country depends on education. Moreover, educational policy plays crucial role in determining the achievement of goals in the sector thereby affecting economic development of a nation. This section reviews historical trend of education and educational policy experience of Ethiopia.

Education in Ethiopia started the fourth century ago through church education. Until the early 1900s, formal education was limited to a system of religious teachings and presented under the sponsorship of the Ethiopian Orthodox Church. These Church schools aimed to prepare individuals for the clergy and for other religious duties and positions. In the process of achieving this objective the schools also provide religious education to children of nobility and to limited tenant farmers sons. Because imprudent policies of education caused only few children to receive education, the Amhara and Tigray nations had the favour to education. (Woubet, 2007)

At the end of the 19^{th} century Menelik II had allowed the European missionary schools. At this period the Islamic schools provided education to some part of Muslim population. But at the beginning of the 20^{th} century, the failures of the education system to meet the required needs of people involved in statecraft, diplomacy, commerce, and industry led to the introduction of government-sponsored secular education. The first public school to provide a western style education was the Ecole Imperiale Menelik II, which was opened in October 1908 under the guidance of Hanna Salib and a number of Copt teachers. Because of misguided policies and low levels of educational standards even when compared to other African countries, it could not bring about the expected changes. Most people agree that the education system undergo many weaknesses in quantity, efficiency and relevance because of four main problems. The first is education and training policies only focused in solving immediate problems, rather than undertaking the major challenges at the country level. The second weakness is children and girls were not allowed to be present at schools. Thirdly, neither the student nor the teachers had a clear vision of what they were learning or teaching since there was no specific profiles set for students at different levels. Because of these problems education of the period cannot contribute much to solve the nations' socio-economic problems (ibid).

Further educational teachings started 50 years ago, with more planned and coordinated expansion of education after 1941 during the Imperial period. The main purpose of education had been to produce trained manpower that could run the state bureaucracy and basically to replace expatriates who had worked in the state machineries by Ethiopian nationals.

After 1941, tangible educational policies were introduced to promote education in the country. Because of the war with Italians under the Menelik II period, many schools were destroyed. The Ethiopian Government ruled by Emperor Haileselasse started reconstruction the education system with the reestablishment of the Ministry of Education in 1942.

To enhance expansion, a Board of Education was established in each region and an educational tax was also introduced to partly finance education. To supplement government efforts, private and voluntary organizations were encouraged to open schools. The missionaries were also, for the first time, officially invited to participate in providing educational services. From 1942 until 1955, the Ethiopian Government was engaged in the expansion of the education system. The high expenditure on education in relation to total expenditure, as well as the rapid growth of student enrolment showed the commitment of the Ethiopian government to the expansion of education Woubet (2007)p 17.

There were Five-Year development Plans which helps the quality and quantity of the educational system in the country under the imperial regime. As a result from 1942 to 1972, the education sector was expanded in a good progress. Gross Primary enrolment increased by 60% between 1968 and 1972. Between 1961 and 1971, the government expanded the public school system and it declared universal primary education as a long-range objective. In 1971 there were 1,300 primary and secondary schools and 13,000 teachers, and enrolment had reached 600,000 (ESDP III, 2005/06).

Even though the education sector shows a high growth trend at the time but there were also some problems. The first problem was lack of resource to expand the sector well. But at the beginning of 1970s the major headache of the government was the inability of the economy to absorb those who were already graduates from the sector. However, this issue of the unemployment of graduates was not a main problem until the 1970's. In this period educational sector had been performing better. In 1974, when the regime of Emperor Haile Selassie was removed from power, the total number of elementary schools (1-6) was 2,754 and the number of students was 859,831. The number of secondary schools and students was 420 and 31,296 respectively. Only 15.3 percent of the age cohorts were attending primary schools in the period under consideration. The figure, compared to our neighbours Kenya and Tanzania that had reached a stage of universal primary education, implied that Ethiopia had underdeveloped educational sector. Even other African countries such as Sudan, Zimbabwe and Zambia, respectively, had 51%, 72% and 95% of their primary school aged children enrolled at school. Thus, the total participation rate of the population in education was low by the African standards before 1974 (Woubet, 2006).

During the time of the Derg regime, the structure and organization of educational activities were changed in conjunction with socialist government ideology. Under this period, Educational Guideline was issued which states free education programs for a broad mass of the population. The goal of the government for education was for production, scientific consciousness and political consciousness (MoE 2000/01).

The Derg regime had worked a lot in distributing schools in rural areas which were neglected under the imperial regime. As a result of this expansion of schools, the number of students had increased. In 1989/90 academic year the number of elementary school students was 2.86 million. The number of primary schools increased significantly in all regions except Eritrea and Tigray, where there was a decline due to the apparent political instability (ibid)

The basic problem that hindered the well development of the education sector under the Derg regime was the highly discouraging regulation of the government for Private sector development and the development of the market incentive structure both in the education sector and in the labour market (Woubet, 2006).

Under the current regime, the emphasis for education is superior. This is because the government has realized that the development of education sector is a base for economic and social development of a country. In the past 15 years, there had been alarming progress in expanding primary education all over the country. Main focus was given to primary education because it is believed that literate citizen can bring the intended democratic system to the country. The current primary school enrolment showed pleasant progress compared with the year 1991. Total primary school enrolment has increased from 19% in 1983 to 91.3% in 2006. At the same time the number of schools has increased from 8,434 to 19,412 for the same years compared above. The number of students has also increased from 2.06 million to 13.5 million. There is also a progress in a secondary level education. The total number of secondary students in 1991 was 416,082 where total coverage of secondary education in percentage was only 6% at the same time period. But in 2006 the number of students had increased to 1,066,423 where the total percentage increased to 33.2% (ibid)

The comparison across years clearly describes the progress. The table below shows the expansion of the three level educations comparing year 1991 and year 2010.

Table 3.1: Education sector comparison between year 1991 and 2010.

Institutions	1991	2010
Primary level	8,434	26,951
Secondary level	275	1,335
Vocational education and training	17	460
Public higher education	2	22
Private higher education	0	70

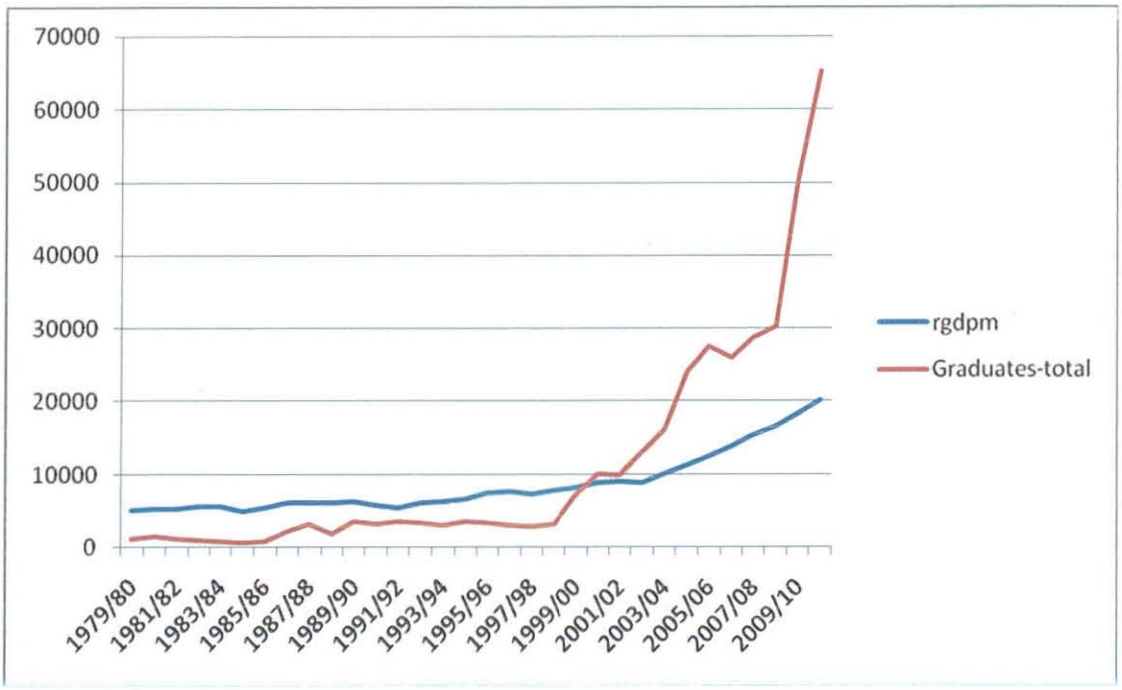
Source: MoE annual abstracts and fliers.

As it can be seen from the table above the institutions under all level of education sector has shown a significant increase in comparing the two years. The basic reason for this higher increase in the construction of the institution is because of the increased emphasis given to the education sector by the current government.

3.2 Higher Education Graduates and Output trends in Ethiopia

The trend in output and higher education graduates at the outset share similar patterns. Both tend to stagnate in the Derg regime with the exception that total number of graduates once jumped in 1986/87 and continued with the previous pattern of stagnation.

Figure 1: Trends of Real GDP in Millions of US Dollar and number graduates



Source: Own calculation and World Bank data base.

The performance of RGDP is impressive since 2003/04 when the economy started the persistence double digit growth. This performance continued until 2010/11 with the exception of 2008/09 when the economy relatively grew only at 8.79% due to the global economic crisis[3] and poor macroeconomic management. The total number of graduates took a new pattern since 1999/00 when the number of graduates increased by 124.5%. Further the number of graduates increased by around 50% in 2004/05. In 2009/10, the graduates increased by 65.36% as the newly established universities graduated their students and the capacity of the existing ones expanded. Therefore, both RGDP and

[3] The global financial crisis that erupted in September 2007 affected Ethiopian economy only after it was turned into global economic crisis. (IMF, 2010)

number of graduates dramatically increased in the past eight to 10 years after two decades of almost stagnation. The question "Is this common pattern systematic?" cannot be answered from such descriptive analysis and the subsequent chapters try to deal with it through an estimation of growth equations.

3.3 The Status of Higher Education in Ethiopia

Higher Education in Ethiopia includes institutions that offer postgraduate and undergraduate programs for three and more years. Between the years 1950s and 1980s, Ethiopia had only two universities (Addis Ababa and Asmara) and no graduate studies had begun in earnest till 1979 and the mid-1980. The two Universities for a long time could not contribute to the nation building endeavours up to the desired level. In response to the persistent attention given to this sub-sector, various activities have been conducted to move forward the role it is expected to play in the development efforts. Due to the organized and concerted steps, the number of full fledged Universities in 2003 E.C (2010/11) increased to twenty two public universities including four public institutions (Ethiopian Civil Service University, Defense University College, Telecommunication and Information Technology College, and Kotebe Teachers Education College) (MoE Annual abstract 2010/11).

In the year 2003 E.C. (2010/11) the total enrolment (undergraduate and postgraduate) of the higher education institutions in all programs; regular, evening, summer and distance is 467,843 of which 79,314 are enrolled in non-government higher education institutions, and this accounts for 17.0% of the total enrolment. In addition, 447,693 (95.7%) of the enrolments comprise the undergraduate degree program (ibid)

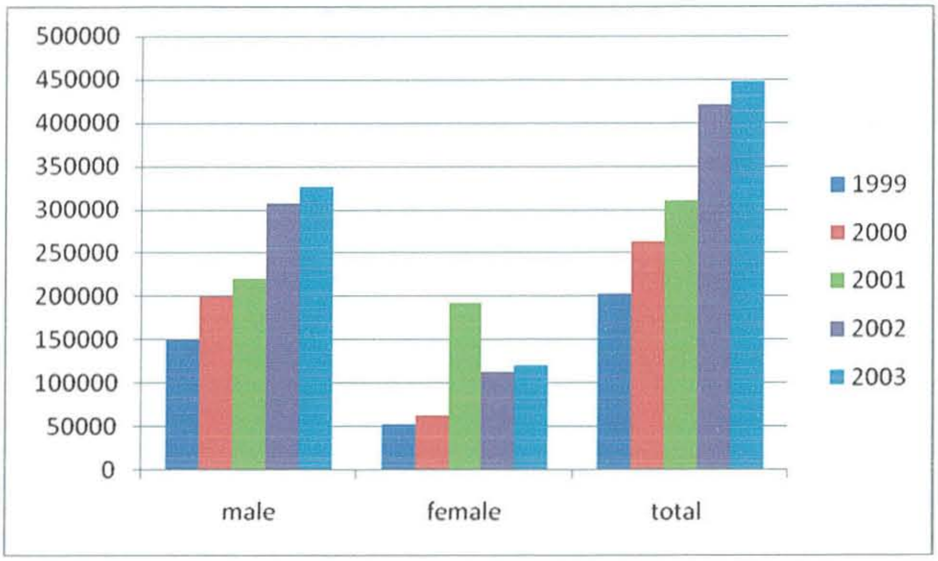
Table 3.2: Enrolments in undergraduate

Year	Male	Female	Total
1999 E.C. (2006/07)	150,530	52,869	203,399
2000 E.C. (2007/08)	199,684	63,317	263,001
2001 E.C. (2008/09)	220,510	90,192	310,702
2002 E.C. (2009/10)	306,758	113,629	420,387
2003 E.C. (2010/11)	326,769	120,924	447,693

Source: MoE annual abstract, 2010/11.

The increase in the enrolment of undergraduate student is shown in the chart below. The chart shows an increase in the number of both female and male students over time. The main reason for the increase in the number of students is due to the increase in the number of universities in comparing years 1999 E.C and 2003 E.C. The number of universities and other higher education institution increase the capacity of the institution to enrol students. Not only the enrolment amount increased but also the number of graduates from different levels of higher education.

Fig 2: Enrolment over years



Source: MoE annual abstract, 2010/11.

As defined earlier, graduates in this study are those who complete their study at the higher education institutions, from, undergraduate degree, postgraduate masters, or postgraduate PhD programs. The following table shows the trend in higher education graduates for different years.

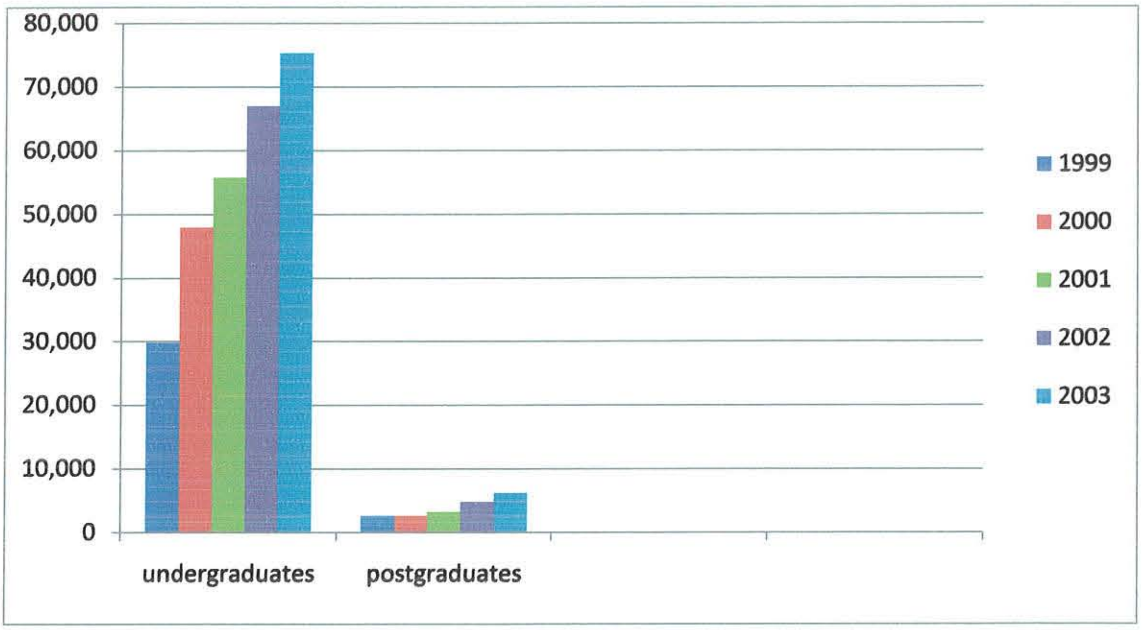
Table 3.3: Trends of Graduates from under graduate and post graduate programs

Year (E.C)	Undergraduate Degree	Postgraduate Degree
1999	29,845	2,671
2000	47,979	2,664
2001	55,770	3,257
2002	66,999	4,873
2003	75,348	6,250
Average Growth Rate	24.9	22.9

Source: Annual report of MoE, 2010/11.

Figure 3 shows the trends noted above graphically for both undergraduate and postgraduate degrees programs. It clearly shows that the number of graduates from undergraduate and postgraduate programs increases as the time goes from 1999 E.C to 2003 E.C. This is because the capacity of higher education institution to enrol students increases because of the newly constructed universities in different regions of the country. Additionally, the existing universities expand their enrolment rate and started the post graduate programs in different fields.

Figure 3: Trends in Graduates from All Programs of Higher education



Source: MoE annual report, 2010/11.

3.4 The Recent Higher Education Policy

For the past decades the country has strengthened its higher education system in science and engineering fields as a strategy for development. In the 1990's this assumption became widespread and most industrial and developing countries began improving their higher education systems, particularly in sciences, mathematics, engineering and technology. This was to prepare the country for knowledge economy that can increase the capacity for research leading to innovation and to be successful in world market. The experience of China, India, Japan, Korea, Taiwan, Ireland, Spain, Turkey and many other countries show that it is essential to develop such a strategy (Teshome, 2010).

Ethiopia adopted this strategy since 2008/09. This is because it is assumed that the country needs to expand its higher education base and focus on expanding science, technology and engineering fields to become competitive and accelerate its development towards becoming a middle income country in the coming two decades. This is the basis for the current intervention of increasing the ration of science and technology programs in the development and expansion of the higher education sector in Ethiopia (ibid).

The current government of Ethiopia has decided that the ratio between natural science and social science fields would be 70:30 starting from the year 2008/09. The major concerns in deciding this ratio relates to the country's vision of becoming a middle income, globally competitive country with accelerated economic development and social transformation. It is assumed that the Production of human resource in the field of science and technology has a bearing on the transformation of the economic drivers-agriculture, industry, and can guarantee healthy and productive population.

Table 3.4: Number of graduates from natural science and social science

Year	Social Science	Natural Science	Total
2000	19839	8964	28803
2001	21589	8725	30314
2002	29345	20783	50128
2003	37614	27528	65142

Source: Own calculation and MoE annual report, 2010/11.

The focus on sciences and technology can be seen on the polices and strategies of the government such as industry policy and strategy, capacity building strategy and programs, rural development strategy and programs, etc. As it can be seen from the above table, the number of graduates had increased in the successive years. Additionally the number of graduates from natural science stream has shown a dramatic increase in year 2002. The trend in graduates from the two streams implies higher number of social science graduates as compared to natural science graduates.

However, the government is giving priority to science and technology disciplines and related areas that develop individuals with leadership potentials since 2008/09. This will shift the existing pattern of graduates in the future. The new policy groups the disciplines or programs that enroll students into six Bands. A Band is a group of disciplines that are given a certain priority order for expansion and student enrolment during the current planning period. Six faculties are identified as Bands. Band-1 is the faculty of engineering and technology, Band-2 is faculty of medicine and Health Sciences, Band-3 is the faculty of sciences and mathematics and computational sciences, Band-4 is Agriculture and Life Sciences, Band-5 is Business and Economics and Band-6 is Social Science and Humanities . Under each of these Bands students' enrollment is based on the priority order by the demand of the economy and the opportunity of producing job creators and entrepreneurs.

The main objective for formulating such bands is to be able to produce individuals who can bring concrete changes to the socio-economic welfare of the country and would be job-creators, knowledge workers and entrepreneurs. However the cost of increasing the Sciences, Engineering and Technology programs would require a relatively higher investment. This is mainly because of high requirement of investment on laboratories, equipments, chemicals, supplies etc (Teshome 2010).

Generally, educational enrollment and higher education graduates have dramatically increased since the past decade than ever before. Social science graduates slightly exceed natural science graduates in the past five years. A reversal in this trend is expected after few years due to the new policy that gives priority to natural science stream.

CHAPTER FOUR

METHODOLOGICAL FRAMEWORK AND DATA

4.1 Methodology, Variables and Expected sign

The macroeconomic literature on the returns to education is mainly based on the Neoclassical Solow model which is further extended to incorporate human capital. This model considers human capital as an accumulated factor of production and can be represented in a Cobb-Douglas production form. Particularly Mankiw, Romer and Weil (1992) showed that traditional growth theory can contain human capital and provide a reasonable approximation for empirical analysis.

Most empirical studies methodologies are based on Mankiw, Romer and Weil (1992) human capital augmented growth model with fundamental modifications for time series data. This model considers human capital as an independent factor of production. As in Griliches (1997), the main method to test the productivity of schooling is through including it as a separate variable in an estimated production function.

This study uses a time series analysis so as to explore the contribution of higher education to economic development in Ethiopia. Basically; the paper follows Tin-Chun Lin's (2003) methodology. Lin (2003) uses a Time Series analysis in order to explore the role of higher education on the economic development in Taiwan. He applied the Cobb–Douglas model of production function, which is modeled as a function of labor, physical capital, and human capital. The production function is formulated as:

$$Y_t = AK^{\alpha}_t L^{\beta}_t H^{\gamma}_t \quad (1)$$

where Y is real output, K is physical capital, L is labor input, H is the quality of human capital, A is an exogenous knowledge and technological factor, α and β, and γ are the physical capital, labor, and human capital shares, respectively, and t is time trend.

He assumed that individuals invest in education at the beginning of their lives, and then work until they retire or die. The earnings of the individuals depend on their human capital. Human capital is a function of schooling. The cost of spending time on schooling is the foregone earnings. According to him the earnings of an individual who is no longer in school are given by:

$$I = wH(E) \quad (2)$$

Where I is the earnings of an individual, w is the wage per unit of human capital, and H(E) is the quality of human capital as a function of schooling, which is denoted by E. the above earning function can be written in an estimated structural earning function as:

$$\ln I = c + f(E) \quad (3)$$

where c is a constant. From Eqs.(2) and Eqs.(3) human capital can be written as:

$$H = e^{f(E)} \quad (4)$$

The constant term in Eq. (3) corresponds to ln(w). By assuming that $f(E) = E_t$,the production can be re-formulated as follows:

$$Y_t = AK^{\alpha}_t L_t^{\beta} e^{\gamma E_t} \quad (5)$$

From this production function the parameters A, α, β, and γ are to be estimated. According to him Eq. (5) is a transcendental production function, which is a generalization of the Cobb–Douglas production function. By taking the natural logarithms of both sides of Eq. (5) it can be changed to a linear production form as:

$$\ln Y_t = \ln A + \alpha \ln K_t + \beta \ln L_t + \gamma E_t \tag{6}$$

This equation has an implicit assumption of the output growth is linear in the number of schooling. That is as the number of schooling increases output also increases which strongly suggest that human capital has a positive effect on output growth.

But growth is not only a function of labor and capital (both physical and human capital). Different studies have examined the factors underlying economic growth using different methodologies. Studies have placed special emphasis on a different set of explanatory variables and offered various insights to the sources of economic growth. The following are the main ones and the study uses thee variables as determinant of growth in Ethiopia.

Government budget deficit: different theoretical arguments can be given for the negative association of budget deficit and economic growth rates in the context of Ethiopia. It can be argued that mounting fiscal deficit lowers real output growth through distorting effects from higher taxation and government higher expenditure programmes. Additionally fiscal deficit also considered as a sign of macroeconomic instability, which ultimately affects output growth adversely.

Openness to trade: Openness is usually measured by the ratio of imports and exports to GDP. Increased openness to international trade promotes growth because of the increased availability of technologies accompanying knowledge spillovers. It can also affect growth serving as channel of exploitation of comparative advantage, increasing the scale of economies and exposure to competition.

Inflation: it is expected negative relation between growth and inflation. But most researches done in both developed and developing countries indicate weak correlation exists between inflation and growth. But generally inflation has negative impact on growth.

Rainfall: Rainfall has been a significant determinant of poor economic growth for African nations but not significant for other developed countries.

Economic policy: Economic policies can influence several aspects of the economy through investment on human capital and infrastructure, improvement in political and legal institutions and so on.

Therefore growth is not as such simply determined by labor and capital but it is also a function of other economic variables. By considering this into account the paper simplify growth equation and the equation to be estimated is formulated as follows.

$$\begin{aligned} \text{Ln RGDP}_t = {} & \beta o + \beta_1 \text{LnGFCF}_t + \beta_2 \text{ LnGRLF}_t + \beta_3 \text{ LnHUM}_t + \beta_4 \text{LnAID}_t + \beta_5 \text{LnRAIN}_t \\ & + \beta_6 \text{LnOPN}_t + \beta_7 \text{LnCPI} + \beta_8 \text{LnBD} + \beta_9 \text{POLICY} + \varepsilon_t \end{aligned}$$

where,

RGDP = Real Gross Domestic Product,

GFCF=Gross Fixed Capital Format,

GRLF= Growth Rate of Total Labor Force

HUM = human capital,

AID= Foreign Aid

CPI= Consumer Price Index,

OPN = Openness of the Economy,

RAIN= Mean Annual Rain Fall

BD= Government Budget Deficit,

POLICY=policy dummy,

ε_t =error-term

4.2 The data

Time series data on variables such as RGDP, GFCF, GRLF, AID, CPI, OPN and BD are collected from the World Bank Data covering the period 1980-2011. Rainfall data is obtained from National Meteorology Agency and higher education graduates from MoE and Addis Ababa University. These data are collected in Ethiopia over the period 1980 to 2011. The disaggregated values of social and natural science graduates were partly interpolated due to unavailability of non-interpolated series. The non-interpolated data covers the periods 1980, 1995 and 2000-2011. Data from 1981 to 1995 and from 1996 to 1999 were interpolated by calculating the average graduates of social and natural science graduates from the non-interpolated data. The absolute value of Budget Deficit is used in order to change the value into natural logarithm.

4.3 Human capital specification

As Woubet (2006) discussed it well, there are two main proxies to human capital in the early literatures of human capital contribution to economic growth. These are adult literacy rates and school enrollment ratio. The choice of specification reflects ease of data availability rather than suitability for the theoretical concept at hand. According to him adult literacy rates can only be a poor proxy for human capital stock. This is because using adult literacy rates as a proxy for the stock of human capital implies the assumption that the additional investments (like the acquisition of numeracy, of logical and analytical reasoning, and of scientific and technical knowledge) are neglected from the measurement. On the other hand school enrollment ratio also cannot be good proxy to human capital. This is because, enrollment ratios are flow variables, and the children currently enrolled in schools are not yet a part of the labor force, so that the education they are currently acquiring cannot yet be used in production. Hence, enrollment ratios may not accurately represent changes in the human capital stock, especially during periods of rapid educational and demographic transition. As of him, average years of schooling is the current best proxy to human capital in many current studies.

But these are to proxy education stock of a country. These proxies cannot separately identify the impacts of higher education on economic outputs. But Lin (2004) uses graduates as a proxy to higher education impact to the output of Taiwan.

To meet the objectives of the study, the number of students graduated from the higher education institutions is used as a proxy to human capital in this study. The number of graduates is a good proxy to analyze the impacts of higher education on the economic growth of a country, Lin (2004). Moreover to show which field of study is relatively more important to economic growth of Ethiopia, the total graduates data was split into those who graduated from social science and those who graduated from natural science streams.

The current year graduates may not exert any effect on current output growth. This is because of limited work availability for graduates in the labor market of the country. Hence it takes some period to get employed after graduation. Additionally new graduates needs time to learn and adapt their new working environment before they attain full productivity. These reasons explain that the current graduates will not contribute to output of the current year. To adjust this, on average one year lag for the variable higher education graduates is used in the model.

4.4 Test of Stationarity

Regression helps to test the existing theoretical hypotheses and guide to formulate economic policies. But estimating regression parameters and carrying out various hypotheses testing without investigating the data generating process of the variables at work may lead to a false conclusion. The basic problem that may lead to false relationship is the non-stationary of the series. A stationary series is a series whose data generating processes such as the mean, variance, auto covariance etc. does not depend upon time. A series is said to be (weakly or covariance) *stationary* if the mean and auto-covariances of the series depend on time. Any series that is not stationary is said to be non stationary.

A common example of a non- stationary series is the *random walk*:

$$y_t = y_{t-1} + e_t \tag{9}$$

where e_t is a stationary random disturbance term. The series has a constant forecast value, conditional on t , and the variance is increasing over time. The random walk is a difference stationary series since the first difference of y_t is stationary:

$$y_t - y_{t-1} = (1-L)y_{t-1} = e_t \tag{10}$$

A difference stationary series is said to be *integrated* and is denoted as I(d) where d is the order of integration. The order of integration is the number of unit roots contained in the series, or the number of differencing operations it takes to make the series stationary.

For the random walk above, there is one unit root, so it is an I(1) series. Similarly, a stationary series is I(0).

If the variables at work are non-stationary then the result from this type of regression may give a spurious regression result. Where what actually exist may be a correlated time trends rather than a meaningful economic relationship (Granger and Newbold, 1986). Therefore to avoid the seemingly impressive and nice spurious regression results, various stationary testes are available. Such as Augmented Dickey-Fuller Test (1979), Phillips-Perron (1988) test, the GLS-detrended Dickey-Fuller (Elliot, Rothenberg, and Stock, 1996), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992), Elliott, Rothenberg, and Stock Point Optimal (ERS, 1996), and Ng and Perron (NP, 2001) unit root tests can be good tests for stationarity of a series.

To look into the features of unit root test here is a simple autoregressive AR(1) process

$$y_t = \rho y_{t-1} + x_t'\delta + e_t \tag{11}$$

where x_t are optional exogenous regressors which may consist of constant, or a constant and trend, ρ and δ are parameters to be estimated, and the ε_t are assumed to be white noise. If $/\rho/ \geq 1$, y is a nonstationary series and the variance of y increases with time and approaches infinity. If $/\rho/ < 1$, y is a (trend-)stationary series. Thus, the hypothesis of (trend-) stationarity can be evaluated by testing whether the absolute value of ρ is strictly less than one.

The Augmented Dickey-Fuller (ADF) Test

The standard DF test is carried out by estimating Equation (11) after subtracting y_{t-1} from both sides of the equation:

$$\Delta y_t = \alpha y_{t-1} + x_t{}'\delta + e_t \tag{12}$$

where $\alpha = \rho - 1$. The null and alternative hypotheses may be written as,

$$\begin{aligned} &H_0 : \alpha = 0 \\ &H_1 : \alpha < 1 \end{aligned}$$

and evaluated using the conventional t -ratio for α:

$$t_\alpha = \hat{\alpha}/(se(\hat{\alpha}))$$

where $\hat{\alpha}$ is the estimate of α and $se(\hat{\alpha})$ is the coefficient standard error.

Dickey and Fuller (1979) showed that under the null hypothesis of a unit root, this statistic does not follow the conventional Student's t-distribution, and they derive asymptotic results and simulate critical values for various test and sample sizes. Recently, MacKinnon (1991, 1996) implements a much larger set of simulations than those tabulated by Dickey and Fuller. The simple Dickey-Fuller unit root test described above is valid only if the series is an AR(1) process. If the series is correlated at higher order lags, the assumption of white noise disturbances e_t is violated.

The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the y series follows an Autoregressive (AR (p)) process and adding p lagged difference terms of the dependent variable y to the right-hand side of the regression:

$$\Delta y_t = \alpha y_{t-1} + x_t{'}\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + \ldots + \beta_p \Delta y_{t-p} + v_t \qquad (13)$$

This augmented specification is then used to calculate t-ratio. An important result obtained by Fuller is that the asymptotic distribution of the t-ratio for α is independent of the number of lagged first differences included in the ADF regression. Moreover, while the assumption that y follows an AR process may seem restrictive, Said and Dickey (1984) demonstrate that the ADF test is asymptotically valid in the presence of a moving average (MA) component, provided that sufficient lagged difference terms are included in the test regression. In using ADF test, there is a choice of including a constant, a constant and a linear time trend, or neither in the regression. Additionally there is a need to specify the number of lagged difference terms The usual advice is to include a number of lags sufficient to remove serial correlation in the residuals.

4.5 Co-integration test

Many macro time series may contain a unit root. This leads to the development of the theory of non-stationary time series analysis. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be co-integrated. The stationary linear combination is called the co-integrating equation and may be interpreted as a long-run equilibrium relationship among the variables.

A simple approach to test for the existence of co-integration is the Engle–Granger approach. It requires running a regression of y_t on the other k − 1 variables and testing for a unit root in the residuals. This can be done using the ADF tests on the OLS residuals. If the unit root hypothesis is rejected, the hypothesis of no co-integration is also rejected. There are some limitations of the Engle–Granger approach. First, the results of the tests are sensitive to the left-hand side variable of the regression. Second, if the co-integrating vector happens not to involve Y1t but only X2t. . . . Xkt , the test is not appropriate and the co-integrating vector will not be consistently estimated by a regression of Y1t upon X2t, . . . , Xkt. Third, the residual-based test tends to lack power because it does not exploit all the available information about the dynamic interactions of the variables. Fourth, it is possible that more than one co-integrating relationship exists between the variables Y1t....Xkt, If, for example, two distinct co-integrating relationships exist, OLS typically estimates a linear combination of them. Fortunately, as the null hypothesis for the co-integration tests is that there is no co-integration, the tests are still appropriate for this purpose.

An alternative approach that does not suffer from these drawbacks was proposed by Johansen (1988), who developed a maximum likelihood estimation procedure, which also allows one to test for the number of co-integrating relations.

4.6 The Long-run Model

If the variables at work are co-integrated then it is possible to formulate the longrun relationship of the variables. The following three equations show the longrun model of this study.

$$\begin{aligned} Ln\,RGDP_t = \beta o + \beta_1 LnGFCF_t + \beta_2\, LnGRLF_t + \beta_3\, LnTOTAL_{t-1} + \beta_4 LnAID_t + \beta_5 LnRAIN_t + \\ \beta_6 LnOPN_t + \beta_7 LnCPI + \beta_8 LnBD + \beta_9 POLICY + \varepsilon_t \end{aligned} \quad (14)$$

The first regression equation helps to show the impact of overall higher education graduates to the output of the country. This is done by using total graduates from public universities as a proxy to human capital and regress the growth equation. The variable total in the equation is written in one period lag form for the reason that the current graduates will not contribute to current period output because of experience lack and limited work availability.

The second regression equation explains the relative importance of only social science graduates from the total graduates in the universities to the outputs of the country. This is through estimating the same growth equation like in the first regression case but now human capital is proxy by the number of social science graduates. The equation is written as:

$$\text{Ln RGDP}_t = \beta o + \beta_1 \text{LnGFCF}_t + \beta_2 \text{ LnGRLF}_t + \beta_3 \text{ LnSOCIAL}_{t-1} + \beta_4 \text{LnAID}_t + \beta_5 \text{LnRAIN}_t + \beta_6 \text{LnOPN}_t + \beta_7 \text{LnCPI} + \beta_8 \text{LnBD} + \beta_9 \text{POLICY} + \varepsilon_t \qquad (15)$$

The Third regression equation shows the relative importance of only natural stream graduates from the total graduates of universities to the output of the country. This is again by estimating the same growth equation but human capital is now proxied by the number of natural science graduates. The equation is formulated as:

$$\text{Ln RGDP}_t = \beta o + \beta_1 \text{LnGFCF}_t + \beta_2 \text{ LnGRLF}_t + \beta_3 \text{ LnNATURAL}_{t-1} + \beta_4 \text{LnAID}_t + \beta_5 \text{LnRAIN}_t + \beta_6 \text{LnOPN}_t + \beta_7 \text{LnCPI} + \beta_8 \text{LnBD} + \beta_9 \text{POLICY} + \varepsilon_t \qquad (16)$$

4.7 Error Correction Model

The co-integrating regression considers only the long-run analysis of a model, and does not deal with the short-run relationship of the variables. Long-run relationship measures any relation between the levels of the variables under consideration while the short-run dynamics measure any dynamic adjustments between the first differences of the variables. To have a good time series modeling both short-run and long-run properties must be shown. To show a short-run relationship, an Error Correction Model (ECM) was developed dating back to Sargan (1994) but was popularized after Engle and Granger.

Error correction can be formulated as follows

$$Y_t = \beta' X_t + \varepsilon_t \tag{17}$$

$$\varepsilon_t = Y_t - \beta' X_t \tag{18}$$

where β is a co -integrating vector and ε_t is the error term in regressing Y_t on X_t.

Then ECM can be defined as:

$$\Delta y_t = \alpha \varepsilon_{t-1} + \Delta\gamma' x_t + u_t \tag{19}$$

where u_t is iid. The ECM in the above equation simply says that Δy_t can be explained by the lagged ε_{t-1} and Δx_t. Notice that ε_{t-1} can be thought of as an equilibrium error (or disequilibrium term) occurred in the previous period. If it is non-zero, the model is out of equilibrium and vice versa.

The error correction representation of the three equation regression in this study is formulated as follows

$$
\begin{aligned}
d\ln RGDP_t &= \ln A + \lambda ECM(-1) + \theta_1 d\ln K_t + \theta_2 d\ln L_t + \theta_3 d\ln AID + \theta_4 d\ln RAIN \\
&\quad + \theta_5 d\ln OPN + \theta_6 d\ln CPI + \theta_7 d\ln BD + \theta_8 dPOLICY + \theta_9 d\ln TOTAL + U_{1t}
\end{aligned}
\tag{20}
$$

$$
\begin{aligned}
d\ln RGDP_t &= \ln A + \lambda ECM(-1) + \theta_1 d\ln K_t + \theta_2 d\ln L_t + \theta_3 d\ln AID + \theta_4 d\ln RAIN \\
&\quad + \theta_5 d\ln OPN + \theta_6 d\ln CPI + \theta_7 d\ln BD + \theta_8 dPOLICY + \theta_9 d\ln SOCIAL + U_{2t}
\end{aligned}
\tag{21}
$$

$$
\begin{aligned}
d\ln RGDP_t &= \ln A + \lambda ECM(-1) + \theta_1 d\ln K_t + \theta_2 d\ln L_t + \theta_3 d\ln AID + \theta_4 d\ln RAIN \\
&\quad + \theta_5 d\ln OPN + \theta_6 d\ln CPI + \theta_7 d\ln BD + \theta_8 dPOLICY + \theta_9 d\ln NATURAL + U_{3t}
\end{aligned}
\tag{22}
$$

CHAPTER FIVE

RESULTS OF THE ECONOMETRIC ANALYSIS

Before regression there are preliminary testes to be undertaken for well interpretation of results. These preliminary tests are stationarity test, co-integration test and granger causality test. After undertaking these tests it is possible to interpret the longrun and shortrun regression results of the study. This section provides the empirical analysis of the study which can explore the main findings of the paper.

5.1 Test for stationarity

As presented in Table 5.1, the ADF statistic result for all variables shows non-stationarity in level. The table shows the ADF statistic result with the respective p-value. The ADF statistic is smaller than the critical value and the p-value is above 10%. Hence the null hypothesis of unit root (non-stationary) is accepted for all variables in level. In every case, the number of lags included in the regression was chosen using the Akaike Information Criterion (AIC).

Table 5.1: Stationarity test results

Variables	ADF test statistics	p-value	results
LnRGDP	3.013672	1.0000	Non-stationary
LnGRLABOUR	1.859382	0.9825	Non-stationary
LnGFCF	1.289393	0.9456	Non-stationary
LnSOCIALt-1	2.562496	0.9965	Non-stationary
LnNATURALt-1	1.466214	0.9614	Non-stationary
LnTOTALt-1	2.161314	0.9910	Non-stationary
LnAID	2.21446	0.9921	Non-stationary
LnBD	1.708037	0.9762	Non-stationary
CPI	4.345241	1.0000	Non-Stationary
LnOPN	-1.181173	0.2118	Non-stationary
LnRAIN	0.751985	0.8711	Non-stationary

Regressing non-stationary variables will lead to a spurious result that makes interpretations and Conclusions invalid. To avoid this problem differencing the variables is necessary. Table 5.2 shows the stationarity of the first difference of the non-stationarity variables. This shows that all the variables are I(1). All variables are stationary at 1% level of significance except GFCF and AID which are stationary at 5% level of significance.

Table 5.2: stationarity test result for the first difference of the variables

Variables	ADF test statistics	p-value	Results
dLnGDP	-3.089447	0.0032***	Stationary
dLnGRLABOUR	-5.89296	0.0000***	Stationary
dLnGFCF	-2.043045	0.0415**	Stationary
dLnSOCIALt-1	-4.615579	0.0000***	Stationary
dLnNATURALt-1	-4.045290	0.0002***	Stationary
dLnTOTALt-1	-4.382762	0.0001***	Stationary
dLnAID	-2.241902	0.0265**	Stationary
dLnBD	-7.091743	0.0000***	Stationary
dLnCPI	-3.19081	0.0024***	Stationary
dLnOPN	-5.20192	0.0000***	Stationary
dLnRAIN	-6.475637	0.0000***	stationary

(*), (**), (***) show that the null hypothesis is rejected at 10%, 5% and 1% significance levels respectively

5.2 Test for Co-integration

In the above section, the results show that all the variables are integrated of the same order which are I(1) (stationarity after differencing them once). Stationarity test is the first step to test whether the variables at work are co-integrated or not. Co-integration test allows determining the longrun relationship among variables. That is, if the variables are co-integrated then there will be a longrun relationship result in estimating the equation at their levels. Following the Engle-Grangers co-integration test, after checking the variables are integrated of the same order, the next step is to test the stationarity of the residual found in the regression of the three equations at the level of the variables. If these residuals are stationary then the variables are co-integrated so that it is allowed to interpret the results found from the regressions as a longrun relationship among the dependent and independent variables.

Table 5.3: Co-integration test results

Variable	ADF statistics	Critical value	P-value	Result
Residual1	-4.633240	-2.656915	0.0001***	Stationary
Residual2	-4.713732	-2.644302	0.0000***	Stationary
Residul3	-3.862525	-2.653401	0.0004***	Stationary

(***) show that the null hypothesis is rejected at 1% significance levels.

Where Resisual1, Residual2 and Residual3 represents residuals found after regressing the first, second and third equations respectively. As Table 5.3 shows all the residuals are stationary at 1% level of significance. Hence it is easy to conclude that the variables at work are co-integrated so that there is longrun relationship among the variables.

5.3 Granger Causality test

The use of this test as proposed by Granger (1969) is for the application of dynamic model rather than a simultaneous equation model. From the results found the variables Total and Natural Granger cause GDP at 10% significance level. Whereas Social, nearly at 10%, Granger cause GDP. The results are presented in the following table below.

Table 5.4: Granger causality test result

Null Hypothesis	Lags	F-statistics	P-value
lnTotal1 does not Granger cause lnRGDP	4	2.57855	0.0726*
lnRGDP does not Granger cause lnTotal	4	3.69919	0.0229**
lnSocial does not Granger cause lnRGDP	4	1.92007	0.1508
lnRGDP does not Granger cause lnSocial	4	3.17227	0.0388**
lnNatural does not Granger cause lnRGDP	4	3.30022	0.0340**
lnRGDP does not Granger cause lnNatural	4	3.34681	0.0325**

(*), (**), show that the null hypothesis is rejected at 10% and 5% significance levels respectively

The null hypothesis of lnRGDP does not Granger cause all the three variables are also rejected at 5% level of significance. However the interest of this study is to explore the impacts of higher education graduates on the level of output proxy by the real GDP.

5.4 The longrun analysis

Since the variables are co-integrated, there exists long-run relationship among them so that the Ordinary Least Square (OLS) test undertaken makes sense to interpret. The major focus in the interpretation is on the three variables that proxy human capital in education. The table shown below presents the long-run coefficients along with their respective standard errors and P-values. Moreover, the table has three columns (columns one, two and three) each representing different regression equation that enables to examine the effect of total, social science and natural science higher education graduates respectively.

Table 5.5: Output of the longrun mode

Explanatory variables	Equation one	Equation Two	Equation Three
LnGFCF	0.281985	0.262673	0.294839
	(0.066085)	(0.066764)	(0.067948)
	0.0003***	0.0008***	0.0003***
LnGRLABOUR	-0.097083	-0.288929	0.080424
	(2.824624)	(2.793775)	(2.930058)
	0.9729	0.91860	0.9784
LnAID	-0.109589	-0.119497	-0.103226
	(0.039790)	(0.040308)	(0.040847)
	0.0119**	0.0074***	0.0196**
LnRAIN	0.093545	0.107024	0.084803
	(0.118727)	(0.118119)	(0.122668)
	0.4396	0.3752	0.4969
LnOPN	0.119610	0.143773	0.111078
	(0.044261)	(0.043485)	(0.046924)
	0.0133**	0.0034***	0.0276**
LnCPI	0.178076	0.162181	0.200114
	(0.071296)	(0.072317)	(0.072072)
	0.0209**	0.0358**	0.0113**
LnBD	-0.095371	0.081212	0.103541
	(0.042462)	(0.043538)	(0.043457)
	0.0356**	0.0762*	0.0196**
POLICY	0.063742	0.072476	0.062196
	(0.035157)	(0.034714)	(0.036503)
	0.0841*	0.0492**	0.1032
LnTOTALt-1	0.066026	-	-
	(0.027861)	-	-
	0.0275**	-	-
LnSOCIALt-1	-	0.089141	-
	-	(0.035899)	-
	-	0.0216**	-
LnNATURALt-1	-	-	0.042240
	-	-	(0.021539)
	-	-	0.0633*
R^2	0.986933	0.987197	0.986002
F-statistics	176.2321 (0.000000)	179.9208 (0.000000)	164.3578 (0.0000)

DW	2.003873	1.995391	1.969072
Log likelihood	51.45878	51.77571	50.39218
Breusch-pagan Test	0.981292(0.4829)	1.228318 (0.3303)	0.92710 (0.5220)
Breusch-Godfrey Test	0.849426 (0.4433)	0.654992 (0.5308)	1.016986 (0.3805)
Jarque-Bera Test	1.456242 (0.482815)	1.566139 (0.457001)	1.830692 (0.400378)
Ramsey RESET Test	2.502686 (0.1293)	0.275572 (0.6054)	1.326428 (0.1996)

(*), (**), (***) show that the null hypothesis is rejected at 10%, 5% and 1% significance levels respectively

As it can be seen from the above table, interestingly, lntotalt-1, in the first column, yields positive (0.066%) and significant coefficient at 5%. This result tells us that a one percent increase in the total number of graduates in all fields increases total output or GDP of the country by approximately 0.066%. For the equation shown in the second column, lnsocialt-1 has a positive coefficient of 0.089 and is statistically significant at 5% significance level implying that a one percent increase in the number of social science graduates increase output by 0.089%. In the equation of the third column, lnnaturalt-1 has a coefficient of 0.0422 and is statistically significant at 10%. This implies that a one percent increase in the number of graduates from the natural science stream can increase output by approximately 0.04%. This regression result implies the positive and significant effect of higher education graduates on output. Additionally the higher coefficient of the social science graduates relative to the natural science graduates implies relatively more importance of social science graduates than the natural science graduates. This result may be due to data interpolation. It may also be caused by the fact that most of natural science graduates engage in the agriculture and industry sectors in Ethiopia whose returns are diminishing and increase at a decreasing rate respectively. However, most graduates of social science students enter the service sector that possesses increasing return overtime increasing the contribution of social science graduates than the natural science graduates.

The coefficients of the other variables in each of the three equations consistently shows similar sign and significance but different magnitude. For instance, Gross Fixed Capital Formation has a positive and significant effect on output in all equations. This is consistent with the theoretical hunch that physical capital increases output in any economy.

The variable AID has a negative and significant effect. This supports the argument against aid.[4] Openness of an economy has a positive and significant effect on output growth as it is expected. This justifies the theoretical literatures that states positive impact of openness to output growth. Even though insignificant, rainfall affects growth positively. The policy dummy shows that the political environment that shapes the policy making process in the current regime has improved growth of output. The budget deficit coefficient is negative as expected and is also statistically significant. This consistently coincides with the neo-classical literature where budget deficit reduces output growth in the long-run. Growth rate of labor force and consumer price index, respectively, have negative and positive effect on output. In particular, the growth rate of labour force has a negative but insignificant effect on GDP unlike theoretical prediction in growth models that claim higher output following higher labour force. The negative sign, albeit insignificant, may imply that the vast level of unemployment is adding to the number of dependent individuals and lower output. If the unemployment problem outweighs the

[4] See Moyo (2009)

increase in output, the higher growth rate of labour can negatively affect the growth of output though the cost unemployment has in the economy. However, the result for the consumer price index, intuitively remain non-standard and should be investigated in a different framework.

The model diagnostic tests strongly confirm the long-run models. The overall significance test (F-test) rejects the null hypothesis of zero coefficients in all of the models implying the variables are jointly significant at 1% in all the equations. The R^2's also imply good fitness of linear model for output. In each of the equations 98% of the variations in output are explained by the variables in the right hand side. Breusch-Pagan test fails to reject the null hypothesis hence the errors are homoscedastic. The test for serial correlation using Breusch-Godfrey test confirms no serial correlation in the estimated equation. The Jarque-Bera test also tells the normal distribution of each error in each equation. The Ramsey RESET test for correct specification of the model justifies correct specification of the model.

5.5 Short run analysis

The negative and significant effects of the error correction terms (λ) justify the existence of short-run relationship among the variables. The co-integration further implies that the error correction model can be constructed to investigate the short-run dynamics of the system (Engel and Granger, 1987). The result for the error correction representation in the model is presented as follows:

Table 5.6: Output of the Error correction (short-run) model

Explanatory variables	Equation one	Equation Two	Equation Three
dLnGFCF	0.154229	0.148458	0.160480
	(0.057849)	(0.0615)	(0.058436)
	0.0153**	0.0232**	0.0128**
dLnGRLABOUR	-2.637787	-2.900909	-2.382687
	(2.100254)	(2.163936)	(2.184341)
	0.2244	0.1959	0.2890
dLnAID	-0.085308	-0.095688	-0.081546
	(0.044606)	(0.045644)	(0.045228)
	0.0710*	0.0497**	0.0873**
dLnRAIN	0.126023	0.144112	0.108857
	(0.075342)	(0.079372)	(0.075005)
	0.1108	0.0852*	0.1630
dLnOPN	0.017747	0.033003	0.014446
	(0.060733)	(0.061586)	(0.061794)
	0.7733	0.5983	0.8171
dLnCPI	-0.092660	-0.068657	-0.089577
	(0.102146)	(0.106262)	(0.104316)
	0.3757	0.5259	0.4012
dLnBD	0.033590	0.022526	0.043433
	0.035455	(0.036855)	(0.036278)
	0.3553	0.5483	0.25459
POLICY	0.008434	0.002410	0.011964
	(0.021667)	(0.02274)	(0.022315)
	0.7014	0.9150	0.5981
dLnTOTALt-1	0.074509	-	-
	(0.033100)	-	-
	0.0363**	-	-
dLnSOCIALt-1	-	0.096003	-
	-	(0.036988)	-
	-	0.0178**	-
dLnNATURALt-1	-	-	0.052200
	-	-	(0.027424)
	-	-	0.0722*
Ecm(-1)	-0.969637	-0.028181	-0.938139
	(0.228258)	(0.241271)	(0.225843)
	0.0004***	0.0009***	0.0005***

R^2	0.673882	0.658284	0.661076
F-statistics	3.926106 (0.005046)	3.660180 (0.007264)	3.705972 (0.006816)
DW	1.739210	1.749130	1.674753
Log likelihood	55.32071	26.00429	54.74296
Breusch-pagan Test	0.27539 (0.9801)	0.354858 (0.9518)	0.232327 (0.9889)
Breusch-Godfrey Test	0.87926 (0.4356)	0.706821 (0.5071)	0.992192 (0.3912)
Jarque-Bera Test	3.142948 (0.207739)	1.869050 (0.392772)	3.774727 (0.151471)
Ramsey RESET Test	5.078831 (0.0304)	2.126373 (0.0476)	2.472335 (0.0236)

(*), (**), (***) show that the null hypothesis is rejected at 10%, 5% and 1% significance levels respectively

As it can be seen from the table, in the short-run error correction representations, the variables total, social and natural have a positive and significant coefficients in equations one, two and three respectively. The shortrun results, like in the long-run model, higher education graduates variables shows the positive and significant contribution to output growth. Specifically, One percent increase in total graduates increase output by 0.07%. Again a one percent increase in social science graduates increase output by 0.09%. And also a one percent increase in natural science graduates increase output by 0.05%. The result shows relatively more contribution of social science graduates to output than the natural science graduates like in the long-run model.

Physical capital has a positive and significant result as it is expected. AID, CPI and Growth rate of labour force have negative but insignificant coefficients. Aid and Growth rate of Labour force have the same result like in the longrun estimation result where as the sign of CPI in this shortrun model is negative. Even though it is insignificant, the negative sign may be because of higher cost it takes to adjust prices and stabilize the economy in the short-run. Hence, inflation in the short-run negatively affects output. The budget deficit has positive and insignificant coefficient. Although it is insignificant the negative sign may be because the negative impact of deficit on output may not be explored in the short-period. In other words, the deficit that results from expansionary fiscal policy outweighs the short run macroeconomic disturbances owing to the deficit. Rainfall, Openness and policy have positive and insignificant coefficient like in the longrun estimation result.

The F-test shows that all variables jointly are statistically significant at 10%. The diagnostic tests imply correct specification of the model. Breusch-pagan test accepted the null of homoscedasticity. Breush-Godfrey test for serial correlation also accept the null of no-serial correlation. Normal distribution of the error is also supported by the Jarque-Bera test. The Ramsey RESER test fails to accept the null of correct specification of the model. However, the error correction term has a negative and significant value which is enough to tell that the error correction representation of the model is correct in small sample.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In Ethiopia, there has been a substantial expansion of universities in every regions of the country during the current periods. Educational enrollment and higher education graduates have dramatically increased since the past decade than ever before. Output is also growing in the country during the same period. The study raised a question as to whether this common trend is systematic. In other words, to what extent higher education contributes to economic growth in Ethiopia? The study also investigates the newly implemented higher education policy that aims to increase the relative number of graduates in natural science stream. Given the existing relative importance to output of the streams, is it an appropriate policy?

The descriptive analysis shows that total output and the number of graduates are increasing in Ethiopia over the last decade. In the last five to six years in particular, both output and number of graduates are increasing with an increasing rate. Furthermore, social science graduates slightly exceed natural science graduates in the same period. A reversal in this trend is expected after few years due to the new policy since 2008/09 that gives priority to natural science stream.

In order to address the research questions, three output growth equations were estimated through co-integration and error correction framework for the year 1980-2011. The first equation regresses using total number of graduates in all fields as a proxy to human capital. This regression enables to explore the contribution of the graduates at aggregate level. The second regression estimates similar growth equation but using social science field graduates only as a proxy to human capital. This helps to show the effect of only social science graduates to output of the country. The third regression estimates again a similar growth equation but used natural science field graduates only, as a proxy to human capital.

The regression results show that the total graduate from universities has a positive and significant impact on output growth in the long-run and short-run. And when the total graduates are split into the two streams, social science is found to have relatively a larger coefficient signifying its more importance than natural science. This result may be due to data interpolation. It may also be caused by the fact that most of natural science graduates engage in the agriculture and industry sectors in Ethiopia whose returns are diminishing and increase at a decreasing rate respectively. However, most graduates of social science students enter the service sector that possesses increasing return overtime.

6.2 Recommendation

This study encourages the government to focus on the development of higher education in the country since the impact of graduates on output is positive and significant. The study confirms the government's effort in expanding higher education institution in all the regions of the country. This effort is appreciable since it increases the number of graduates and in turn output will increases. But, given the data employed, no evidence has been found on valuing natural more than social science stream. As the social science stream is more important in the country's output growth, the current more emphasis to natural science and engineering fields in Ethiopia is questionable. Hence, the study recommend the government to assess the existing structure of the economy and the educational system in higher educational institutions so as to analyze conditions are favorable to natural science graduates or not. However, the study forwards open questions that need further investigation so as to have an appropriate higher education policy (especially in valuing natural more than social science stream). These include: identifying the channels through which each stream contribute to output; assessing the role of graduates in specific sectors of the economy; and more importantly analysis on the efficiency of graduates employed in each sector to improve designing the composition of gradates in each stream.

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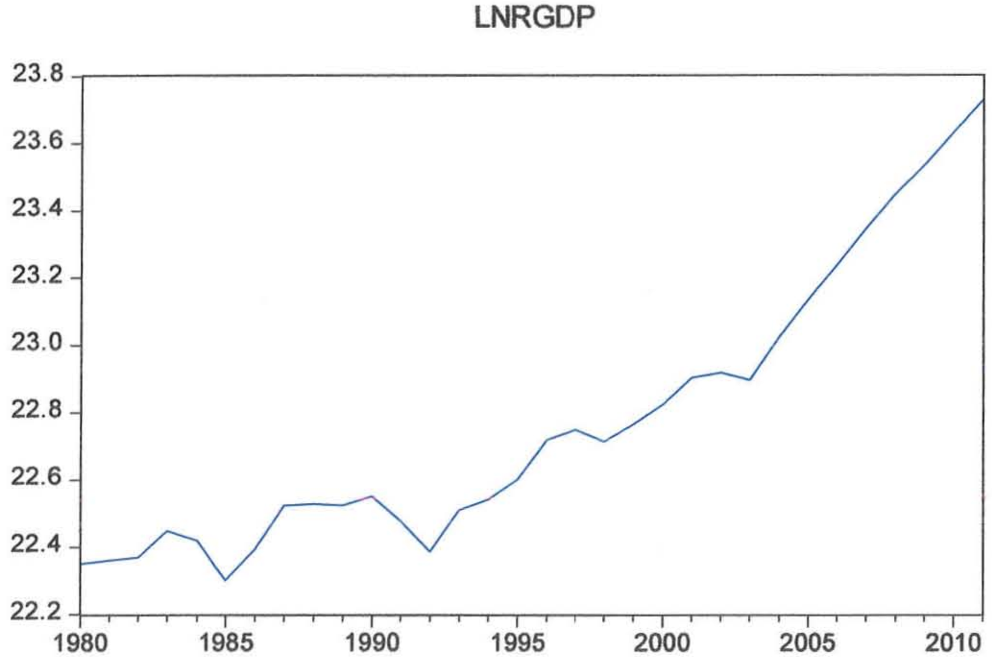
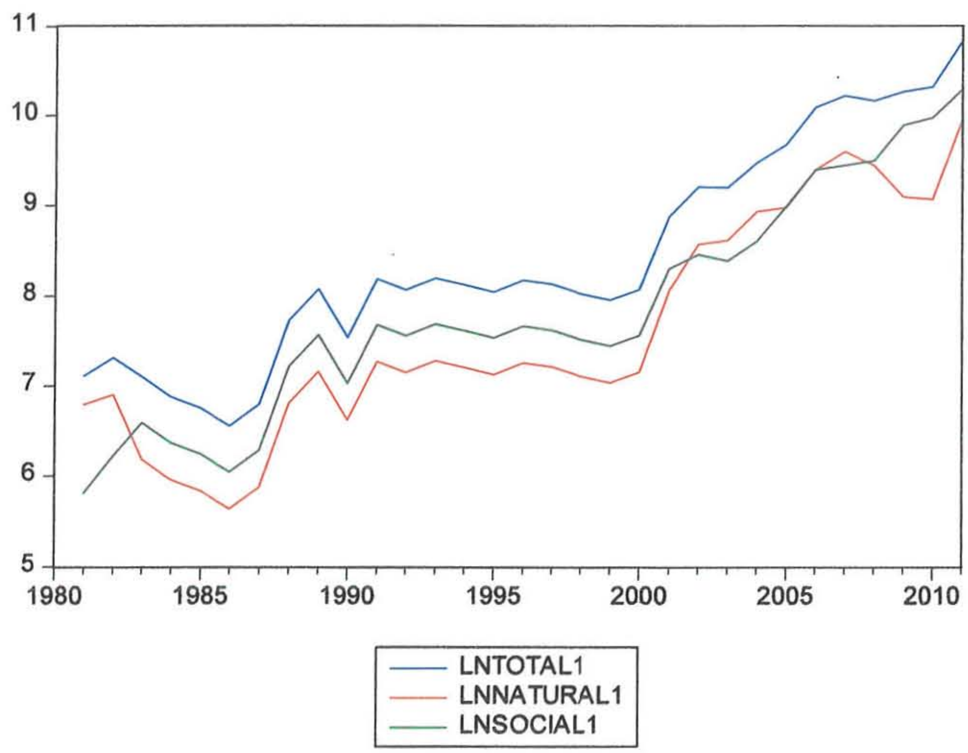
APPENDICES

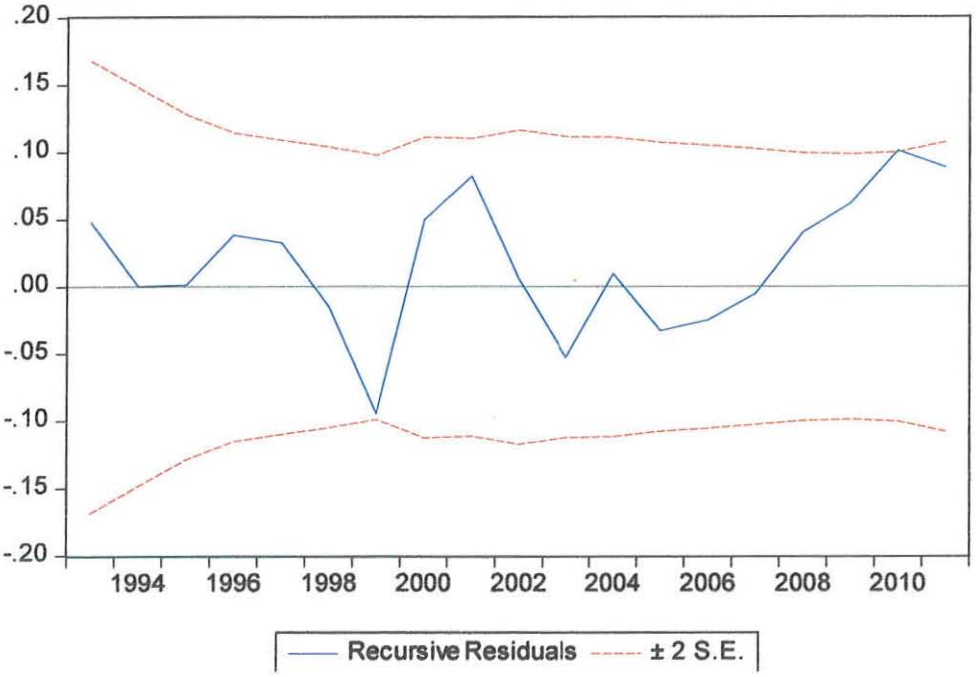
Appendix A: Graphs of RGDP and the human capital proxies



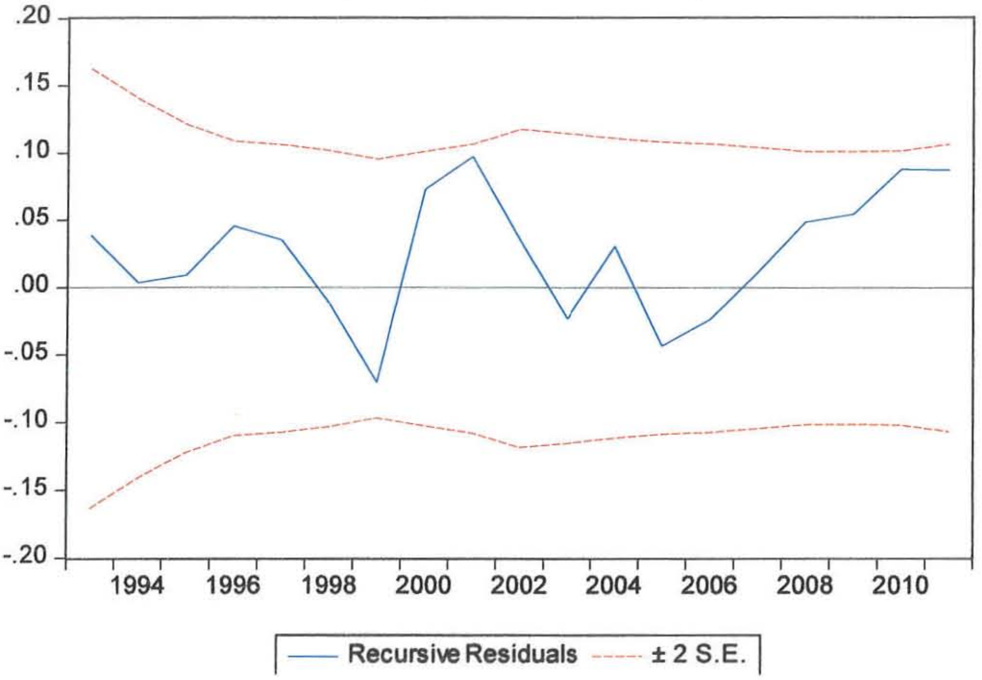


Appendix B: Stability Diagnostic test for the longrun model

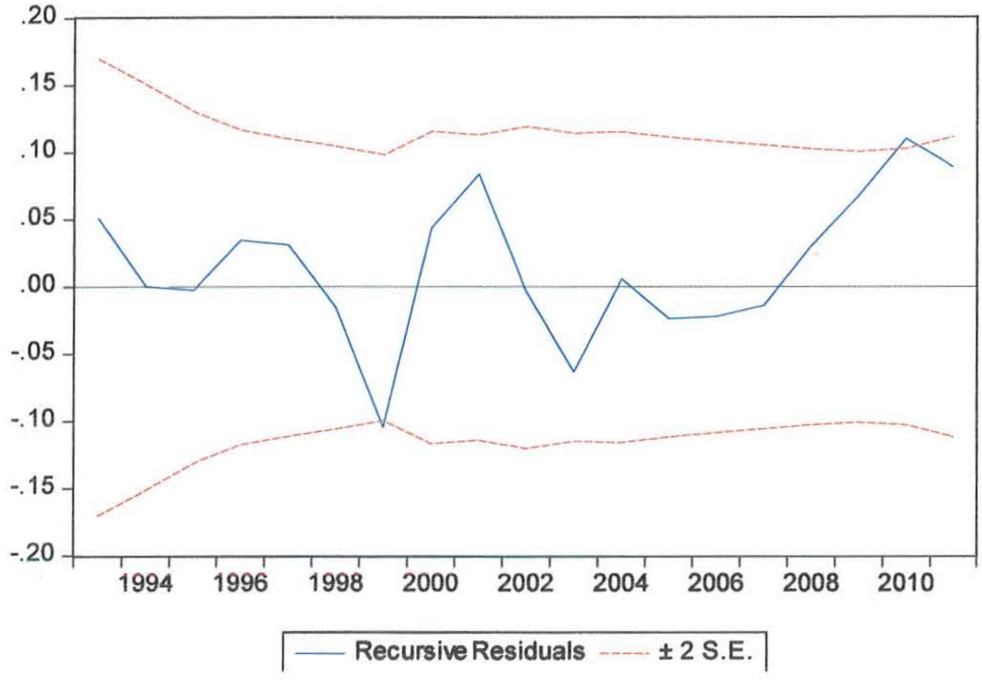
B1- stability diagnostic test for equation1



B2- stability diagnostic test for equation 2

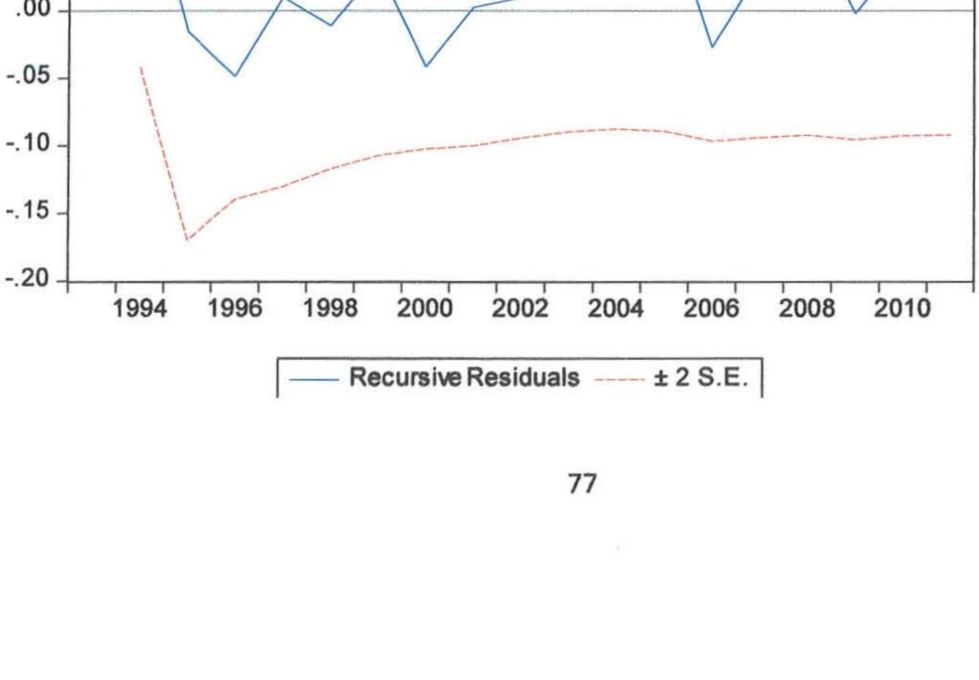


B3- stability diagnostic test for equation 3



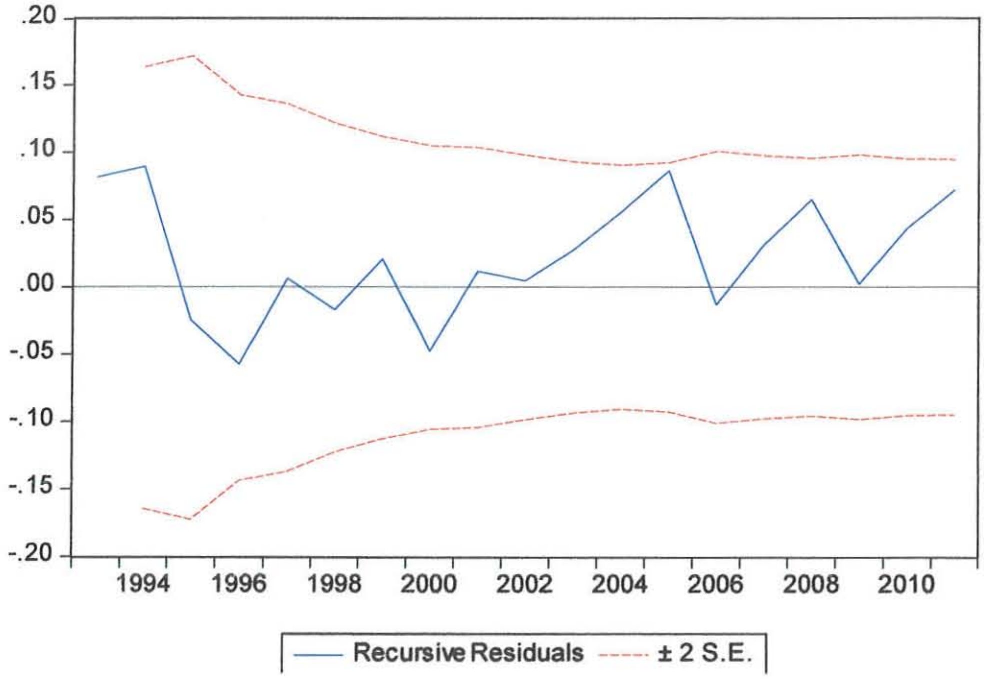
Appendix C: Stability Diagnostic test for the shortrun model

C1- Stability Diagnostic test for Equation1



C2 -Stability Diagnostic test for Equation2

C3- Stability Diagnostic test for Equation3



Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged.

The examiners' comments have been duly incorporated.

Declared by:

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Date: 19/06/2012

Confirmed by (Advisor):

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Date: 18/06/12

Place and date of submission

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