COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ACCOUNTING AND FINANCE

MASTER OF BUSINESS ADMINISTRATION IN FINANCE

THE ROLE OF PRO-POOR PUBLIC EXPENDITURE ON POVERTY REDUCTION IN ETHIOPIA

BY

AYANA ZEWDIE

THESIS SUBMITTED TO ACCOUNTING AND FINANCE IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF BUSINESS ADMINISTRATION

JUNE 2017

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DECLARATION

I undersigned, declare that this thesis is my own work and has never been presented in any other university. All sources of materials used for this thesis have been duly acknowledged.

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This thesis has been submitted for examination with my approval as a University advisor

Abebe Yitayew (PHD)

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ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

Master of Business Administration Program

This is to certify that the thesis prepared by Ayana Zewdie entitled "THE ROLE OF PRO-POOR PUBLIC EXPENDITURE ON POVERITY REDUCTION IN ETHIOPIA" Business management in finance complies with the regulation of the University and meets the accepted standards with respect to originality and quality.

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ACKNOWLEDGEMENTS

First of all, my thanks go to Almighty God for all the blessing, he bestowed on me and continues to bestow on me.

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DEDICATION

With much pleasure, gratitude and honor, I dedicate this thesis to my wife Tsehay Mulugeta and my children, Surafel Ayana, and Yonathan Ayana for their inspirational, unconditional encouragement and patience during my absence

ABSTRACT

The main objective of this study is to assess whether public expenditure on agriculture, education, and health and road construction have a positive and significant roleon poverty reduction. To ensure the robustness of the results, different preliminary tests such as time aeries stationary, serial correlation and co-integration tests are conducted. Data at country level are used for estimating the role of pro-poor public expenditures on poverty reduction. I used ordinary least square econometric analysis by time series data, and conclude public expenditure on agriculture, health and road construction are more effective in poverty reduction in Ethiopia. A strong relationship exists between independent variables and the dependent variable in the model over the period of 1992-2013. The regression model is not spurious as tested. The time series data of these variables contain unit root and they become stationary after conducting ADF test. They have long run relation as indicated by Granger casual co-integration test. The statistically significant elasticity coefficient of OLS estimation at level expresses that the 1% change in per capita public expenditure on agriculture, education and road will change the electricity human development index (HDI) by 0.18%.0.05%, and 0.03% respectively these shows that increasing volume of per capita public expenditure on agriculture, education and road has a role to increase electricity HDI and thereby reduce poverty in the country. Thus, the Ethiopian government should formulate policies that can help to mobilize domestic and foreign aid in the productive sector like agriculture, education and road in order to achieve desired economic growth that can increase electricity human development index and in turn create gainful income to the mass of Ethiopian people to reduce poverty. The results of Error Correction Model indicate that there is both short and long run equilibrium in the system. The coefficient of one period lag residual coefficient is negative and significant which represent the long run equilibrium. The coefficient is -0.237 meaning that system corrects its previous period disequilibrium at a speed of 23.7% annually. In nut shell, the public expenditure management should be based on impact assessment. In other words, spending money on the provision of public goods and services must take in to account the extent to which this expenditure benefits the poor. Therefore, to maximise the poverty reduction role of pro-poor public expenditures, the government of Ethiopia should focus more on the fulfilment and improvement of basic necessities of the poor such as agriculture, primary health care, primary education, rural infrastructures and food security by allocating more public resources to the pro-poor sectors than that of universal and non-basic services and goods.

***Key words**; pro-poor public expenditure, Human development index, co-integration analysis, poverty reduction.*

Table of Contents

List of Tables

List of Figures

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CGE	Computable General Equilibrium
FGT	Foster Green and Thorbecke
HIV	Human Immune Virus
GTP	Growth and Transformation Plan
MOFEC	Ministry of Finance and Economic cooperation
MOFED	Ministry of Finance and Economic Development
MDG	Millennium Development Goal
PCEA	per capita expenditure on Agriculture
PCED	Per capita expenditure on defence
PCEE	per capita expenditure on Education
PCEH	per capita expenditure on health
PCER	per capita expenditure on road construction
PCGDP	per capita gross domestic product
UNDP	United Nation developed programme
USD	united states of dollar

CHAPTER ONE

1 Introduction

1.1. Background of the study

Ethiopia is one of the poorest countries in the world with a per income of US$632(MOFED, 2015) and human development index of 0.435 which stands 170 out of 177 countries in 2014 (UNDP, 2014, p26). Ethiopia is predominantly an agricultural country where agriculture accounts for about 40 % of the country's GDP, 80% of the total export and 74% of employment, making its economy mainly dependent on agriculture. However, the industry and service sectors of the economy account for about 14% and 46% of country's GDP (MOFED, 2015).

The poverty reduction strategy is designed to set the country's economy on the growth path by benefiting the poor. Core government spending in agricultural development, social development and infrastructure enable the poor people to have a chance to get out of poverty. As a result, the Ethiopian economy experienced some recovery between 1992 and 2014.Real per capita GDP increased from Ethiopian USD 80 in 1992 to USD 632 in 2014 (MOFED 2015). In addition, the number of people living below the national poverty line fell from 44.5% in 1996 to 22.9% in 2015(MOFED 2015).

Rapid and sustained poverty reduction requires pro - poor public expenditure to bring economic growth that enhance the ability of poor to participate in, contribute to and benefit from growth. A better public expenditure with increased access to agricultural extension, social and financial services to increase productivity, improved agricultural production, education, transport and investing in social and economic infrastructure helps to kick start growth. Greater expenditure in pro poor sectors, where in this study are classified as education, health, roads and agriculture encourages economic growth and reduce poverty reduction (World Bank, 2005b).

This study is concerned with the public expenditure on four pro-poor sectors of the economy. The study shows the role of government expenditure on pro poor sectors in

reducing poverty. Below is a brief explanation on how pro poor sectors contribute to poverty reduction:

Growth allows government to expand expenditure on pro poor sectors which in turn improves the lives of the poor.

Therefore, the key aspect of pro poor public expenditure in Ethiopia focuses on the extent to which the poor benefiting from it. Pro poor public expenditure indicates that the rural and urban areas have poverty reduction, the availability of health and education facilities indicate the poor households have success. According to the report of poverty status in Ethiopia by MOFEC (2015), it shows that 22.9% of household in Ethiopia live below poverty line. There is strong evidence that goods and equitable access to agriculture, education, health and transport infrastructure and its services not only promote pro poor growth but also reduce poverty. The link and role lies in the fact that, investing in agriculture, education ,health and road infrastructure improves access to economic opportunities by increasing productivity, production and access to social services as well as reducing transaction costs.

A dynamic agriculture raises labor productivity in the rural economy, pulls up wages, and gradually eliminates the worst dimensions of poverty. Study done by URT (2007) shows that there is a strong association between agricultural development and poverty reduction. The study shows that for every 10% increase in farm yields, there has been a 7% reduction in poverty in Africa, more than 5% reduction estimated for Asia. This is the reasons for making agricultural development and human development is a central strategy for pro-poor public expenditure to reduce poverty in the country

Health enhances economic growth, and it seen as a form of human capital and therefore an input into the growth process, as well as an output: countries with educated, healthy populations are in a better position to prosper; especially in a favorable policy environment. The government has its role on economic growth and poverty reduction. Gartner *et al.*, (1998), argued that some government spending will always be desirable in order to promote economic growth and reduce poverty. Regarding the Ethiopian case, In

2003/04, 11.8% of government expenditure as % GDP and 51.1% of the total public expenditure targeted pro poor sectors which increased to 12.2% and 66.5% respectively by 2010/11(MOFEC,2011)

This thesis examines the role of government expenditure on pro poor sector in Ethiopia in 1992-2013. The study was also to observe the role of government expenditure on pro poor sectors, casual relationships which exist between the selected variables and their correlation in the granger-Causality model adopted.

1.2. Statement of problem

Ethiopian economy has experienced strong and broad based growth over the past decade, averaging 10.8% per year in 2003/04 - 2013/14 compared to the regional average of 4.8%. Expansion of the services and agricultural sectors account for most of this growth, while manufacturing sector performance was relatively modest. Private consumption and public investment explain demand side growth with the latter assuming an increasingly important role in recent years.

Ethiopia has been characterized by increased expenditure on pro poor sectors (agriculture, health, education and roads) yet, it is experiencing an economic activity and pro poor growth been shrinking. Poverty is estimated to have contracted in 2015 by more than 15 percentage point, after declining by about 40.8% between 2004/5 and 2014/15 (MOFEC, 2015). This relatively weak relationship between expenditure on pro poor sectors and public expenditure raises concerns over a possible decoupling of economic growth and poverty reduction in Ethiopia.

There is an information gap on the role of public expenditure on pro poor sectors and poverty reduction in Ethiopia. For instance, Reports by MOFEC (2015), revealed that Ethiopia has experienced a significant improvement in its economic indicators. For example GDP and per capita GDP grew at 10.8% and 8% on average respectively for the last decade, Despite these achievements, the decline in poverty has been disappointing, particularly in rural areas. Comparison of poverty indicators calculated from the national household budget surveys shows that poverty declined by only 3% during the 1990s

(from 39 to 36%). In 2001, Ethiopia implemented a medium-term strategy and plans for poverty reduction in the form of GTP, among other things, envisages increased public expenditure on pro-poor sectors that are likely to have greater role on poverty. The priority sectors are basic education, primary health care, rural roads, and agriculture.

With scarce resources it has, the government faces challenges of how can it continue to raise the required resources towards the growth of pro poor sectors investment in line with GTP initiatives. The question is what sectors are reasonably government spends and invest to reduce poverty? The seriousness of government to reduce poverty rate is reflected from how well and where the expenditure is allocated in order to support poverty reduction goal.

1.3. Research questions

- Do pro-poor public expenditures have a role in reducing poverty in Ethiopia from 1992-2013?
- To what extent the pro-poor expenditures have role in reducing poverty in Ethiopia from 1992-2013?
- Do pro-poor expenditures have a strong and positive role in reducing poverty in Ethiopia from 1992-2013?
- Do pro-poor expenditures have short run and/or long run relationship with poverty reduction in Ethiopia?

1.4. Objectives of the Study

The general objective of this study is to analysis the role of government expenditure on pro-poor sectors on reducing poverty in Ethiopia in 1992-2013. The study uses time series data to achieve the following specific objectives:-

i. To examine the role of government expenditure on roads, agriculture, education and health towards poverty reduction in Ethiopia;

ii. To identify the correlation between pro poor sectors (roads, education, health and agriculture) and poverty reduction in Ethiopia; and

iii. To examine the short run and long run relationship between government expenditure on pro-poor sectors and poverty reduction in Ethiopia

1.5. Significance of the Study

It identifies the role of government expenditure on pro poor sectors on poverty reduction. Therefore, adding additional information which form basis for policy formulation so as to reduce poverty; It also provides useful theoretical and practical knowledge on factors that constrain the pro poor public expenditure of Ethiopia in poverty reduction. In addition, the results of the study and recommendations are expected to contribute to the existing body of knowledge in the academic field, policy and decision makers, development partners, practitioners and stakeholders; The study is providing

1.6. Scope of the Study

The study will examine the role of public expenditure on education, health, agriculture, road construction and GDP on poverty reduction at a national level of time series data in Ethiopia. To achieve this objective, the period range from 1992 to 2013 is chosen.

1.7. Limitations of the Study

This study will have some limitations. Among these, the most critical is the data quality. Lack of relevant and consistent quality data on many indicators related to public expenditure and poverty, will create problems concerning the reliability of the results. In addition, those available data are not organised, standardised or systematically compiled at each level such as by regions, and sectors. Therefore, without such data or information it will be difficult to estimate and evaluate the role of various government expenditures

on poverty reduction. Even though there will be problems with data inconsistency and availability, compiling such data from official and unofficial publications of different organisations can produce the final results which are not totally unrealistic. In addition, the challenge for future research lies in deepening the analysis by going beyond the analysis of aggregate sector spending across regional states of Ethiopia and gaining better understanding of the role of sectoral and subsectoral spending policies

The financing type, that is domestic debt, increased taxes or foreign aid (grants or loans) and reduction of expenditure in other areas etc. have also a role on poverty reduction. This study, however, focuses only on assessing the roles of public spending but not taking in to account the external financing on poverty reduction. Therefore, this analysis does not include all the financing strategies due to the unavailability of long time series data. Hence, this study is not a broader analysis to assess the full effects of public expenditure. Hence, ignoring the financing part of expenditures is another limitation of this study.

Due to Lack of quality and consistent long time series data, this study cannot take into account the too long lagged effects of public expenditure on education, agriculture, health, and road construction on poverty reduction. So, it is not possible to give empirical evidences on the indirect benefits of public expenditure on poverty reduction.

1.8. Organisation of the Paper

This paper starts with introduction. In the second chapter, literatures were reviewed the trend and level and composition of government spending as well as sketch Ethiopia's poverty profile in Ethiopia over the last 22 years and conceptual framework was presented. In the next two chapters, Research methodology was explained in chapter three, whereas chapter four focuses on presentation, analysis and discussions. Finally; summary of major findings, conclusion and recommendation have been presented.

CHAPTER TWO

2 Literature Review

2.1 Theoretical and Empirical literature review

Most studies on the role of public expenditure on poverty reduction have been conducted using cross-sectional data across countries. For example, Fan et al. (2004, 2002, and 1999), and Lofgren and Robinson (2004) find a positive relationship between poverty reduction and public expenditure on agriculture, education, health and road construction. Similarly, Datt and Ravallion (2002) conclude that public expenditures have positive and statistically significant role on poverty reduction using a poverty headcount ratio across the Indian states during the period 1960-1994. In addition, Foster and Szekely (2001 p. 25) carried out regression analyses by using cross-sectional data from 20 countries to estimate the role of government consumption on means of the poor. They conclude that government consumption as a share of GDP tends to have a positive role on poverty reduction by increasing the income of the poor.

According to Gomanee et al. (2003), government expenditure in education, agriculture, health, water, and housing has a positive and statistically significant role on poverty reduction. They reached this conclusion by using cross country data and also by holding the level of GDP per capita constant. They estimated the role of public expenditures on those sectors with the US $1 a day poverty headcount. Moreover, they conclude that public expenditure on education, agriculture, health, and housing have an role on poverty through their direct effect on income inequality by shifting the income from the rich towards the poor.

All studies carried out by Fan et al (2004, 2002, 1999) using regression analysis on cross sectional data from India, China, Uganda and Thailand confirmed that public expenditure on agricultural research and development, rural roads, rural education, and other rural development expenditures have a positive and statistically significant role on poverty reduction. These results are independent from GDP growth and how the government

finances expenditures. In particular, expenditure on agricultural research and development, and rural roads has the largest role on Indian rural poverty reduction. The regression analysis using cross sectional data from Chinese provinces also shows that spending on rural education has the largest positive role on poverty reduction, followed by agricultural research and development expenditure, and spending on rural road construction. However, the dynamic Computable General Equilibrium (CGE) analysis using cross-sectional data for Sub-Saharan Africa by Lofgren and Robinson (2004) indicated that public expenditure in education and health has significant and higher role on poverty reduction than road construction spending.

Public spending on education enables one to make use of the advantages of technological development, encouraging people to be more productive by altering production techniques, types, and varieties of output. It also increases the employment opportunities. For example, Adamu (2002) and Buffle (1994) show that expenditure in education are used for human capital formation and thereby enhance labour productivity. In addition, Dabha-Nirros and Matovu (2002, pp. 22-23) find that government expenditure on primary and secondary education has positive role on poverty reduction. In particular, they conclude that poverty headcount and poverty severity indices declined significantly when primary education spending is increased relative to secondary or tertiary spending. They argue that an increase in primary expenditure leads to higher aggregate human and physical capital accumulation in the short run, but secondary education expenditure has a long run effect on poverty reduction. In contrast, using regression analysis on panel data from 14 Indian states, Jha et al. (2001, p. 17) find that public expenditure on higher, technical and vocational education is more effective in reducing poverty compared to elementary and secondary education.

On the other hand, Dollar and Kraay (2002, pp. 25-26) use micro cross country data to estimate the link between public spending on education and health with poverty. Based on such analysis, they conclude that government expenditure in education and health has a negative role on the income of the poor, but the coefficients of the variables are statistically insignificant.

Therefore, from the above evidences, public expenditure in education positively affects the formation of human capital and then productivity. However; without better targeting, public expenditure in education will have a negative or insignificant effect on poverty reduction (see Jung and Thorbecke, 2003, p. 24).

Similar to education, agricultural expenditure in research and development enhance agricultural productivity and in turn can contribute to poverty reduction by stimulating growth in the rural economy. Public spending on agriculture, in particular on research and extension, enables the poor farmers to adopt new varieties, new production techniques and other modern farming techniques. These, in turn, affect poverty reduction by raising the income of the poor, changing the demand for agricultural labour, reducing the food prices, which then makes the incomes go further, and by stimulating growth.

For instance, using regression model, Fan et al. (1999) for India, (2004) for Uganda and Vietnam shows that investing in agriculture brings the highest level of poverty reduction.

Roads help the poor transport their goods to and from the market, create employment opportunities, and give better access to health and education services as well as other political, social and economic services. Therefore, public expenditure in road construction can influence poverty reduction by increasing agricultural productivity, non-farm employment opportunities, and raising the wages and employment of the poor. In addition, higher productivity and expanded employment lead to higher economic growth, which in turn affects the prices of goods and then the well-being of the poor. A number of studies show that public expenditure on road construction has a significant effect on poverty reduction. For example, a study conducted by Kwon (2000) on Indonesia estimates the effects of government expenditure in road construction on poverty reduction. He finds that road construction expenditure significantly reduces poverty incidence through the improvement of wage and employment creation.

Related studies on China, Nepal and Vietnam in Ifzal Ali Ernesto and M. Pernia (2003, pp. 5-6) reveal that poor households living in areas with better road access have the higher probability of escaping poverty than those without better road access.Moreover,

Agenor et al. (2004, p. 39) use the macro framework model to a trend based projection data for Ethiopia covering the period 2003-2015 and find that simulated decrease in consumption spending and reallocation to investment expenditure with higher increase in infrastructure relative to education and health have a modest effect on poverty reduction.

This chapter shows that there are evidences that public expenditure has an role on poverty reduction. However, most empirical evidences on the link between public expenditure and poverty reduction are focused on Asian countries which have sufficiently consistent, detailed and reliable data on public expenditures and poverty indicators. There is little evidence on African countries. In addition, most empirical studies on the role of public expenditure on poverty reduction have been conducted using cross-sectional data to explain the observed differences in poverty reduction across countries. But, cross-sectional analysis cannot capture the country specific role of government expenditure in poverty alleviation. Furthermore, cross sectional analysis can identify correlations but not causality between variables. Therefore, this study uses time series data to estimate the country specific role of public expenditure on education, health, agriculture, and road construction on poverty reduction, and also to assess the correlation, magnitude and the sign of the effects of these expenditures on poverty reduction.

2.2 Government expenditure, poverty situation in Ethiopia and conceptual framework

2.2.1 Government expenditure

Economic theory provides a justification for government expenditure. The main justifications are market failures and creating enabling environment for private sectors. Poverty reduction consideration also leads governments to intervene in the economy for providing goods and services to those in need. Even though, economic theory suggests the rationale for public expenditure, public spending has two side effects in promoting growth and reducing poverty. On the one hand, it is used for capital accumulation and solving the problem of market failure in case of public goods and externalities. On the other hand, the financing of such public expenditure needs higher taxes which lower the net income of taxpayer. Therefore, the main question is how to spend and finance the

public expenditures appropriately? Hence, this study focuses on assessing whether the poverty targeted expenditure is spent properly and thereby reducing poverty or not?

As it was stated in the previous chapter, the difficulty in compiling a time series data for this study is lack of consistent, standardised or systematically organised data, particularly on public spending and poverty indicators. This reflects the frequent revision of accounting within public expenditure and lacks well organised information system for budget analysis and compiling. But for this study, data were gathered and compiled from the Ministry of Finance and Economic cooperation (MOFEC), United Nation Development Programme (UNDP), World Bank and other organisations' official and unofficial publications.

In this section, definition of public expenditure and poverty in the context of this study have been addressed, and data presentation or measurement for the purpose of this study, and finally the trend, level and composition of public expenditures.

2.2.1.1 Definition

There is no unique definition of public expenditure. However, for the purpose of this study, public expenditure is defined as all expenditure by the government for the provision of public goods and services, or all spending made by the government on resources that are acquired by the people(World Bank, 2005)..

2.2.1.2 Measurement of public spending

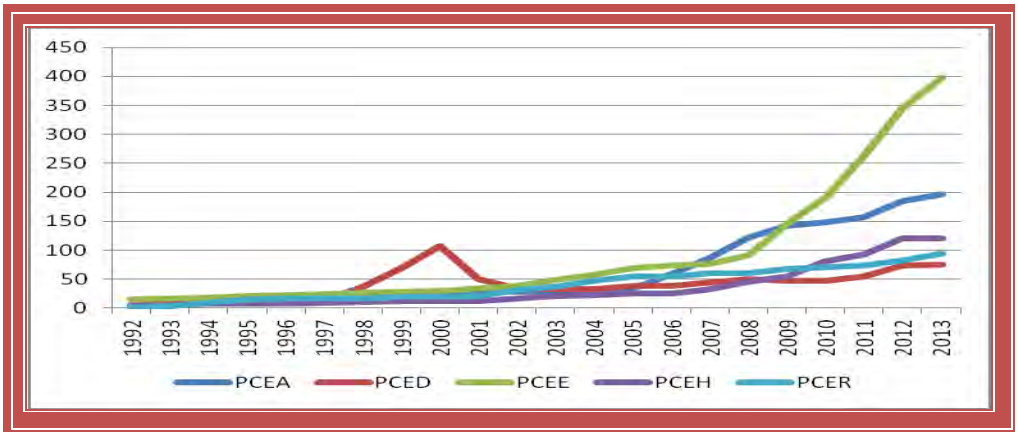
Here also, like the definition, there is no single or uniformly accepted measure of public expenditure. However, the most commonly used measures of public expenditure level, trend and composition is relating public spending to gross domestic product (GDP), or the per capita spending. For the purpose of this paper, per capita expenditure, the ratio of total spending of poverty targeted expenditure to total government expenditure were used in this study.

2.2.1.3 Trends, level, and Composition of government expenditure

Government expenditure in real 1990 prices increased from Birr 4.2 Billion in 1992 to Birr 166.7 billion in 2013, a growth rate of more than 7% per annum. During the period under review (1992-2013), the trend of real government expenditure growth was not uniform but rather, it fluctuates year to year. Relatively, higher increase occurred in 1994 and 2012(35.9%), 1999 (32.9%), and 2006 (47.2%). In addition, the average increase in government expenditure for the period 1992-2013 was about 19 % (figure 1).

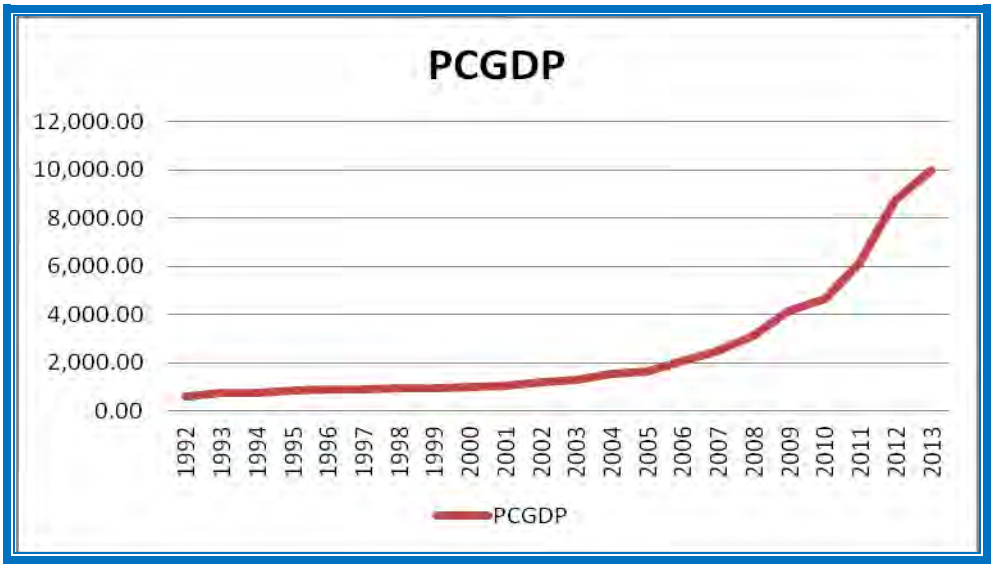
As you see from figure 1 below, Over the last 22 years, the average annual growth rate of public expenditure on agriculture, education, health, and road construction in real terms was 7.44%, 5.4%, 4.9%, and 12.1%, respectively.

Figure 1: per capita public expenditure on poverty targeted expenditures and Human development Index in Ethiopia 1992-2013 in prices of 1990 (in Billion Ethiopian Birr



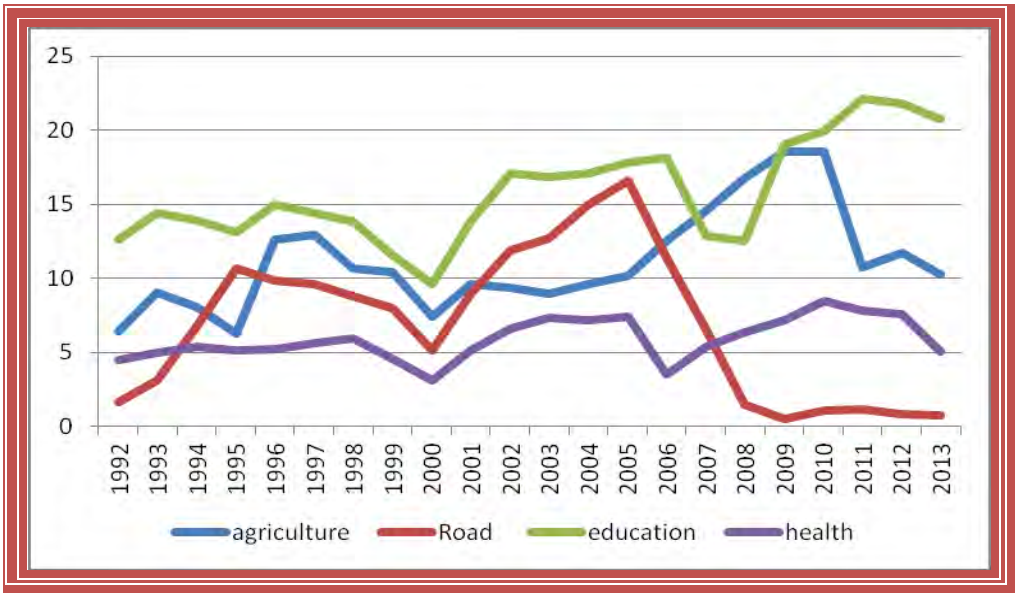
Source: Ministry of Finance and Economic cooperation (MOFEC) ,2002,,2012 20015, and World Bank ,public expenditure review(2004,2014,2016 and Various Issues) and Own Calculation

Figure 2: per capita Gross Domestic Product (PCGDP) in Ethiopia 1992-2013 in prices of 1990 (in Billion Ethiopian Birr)



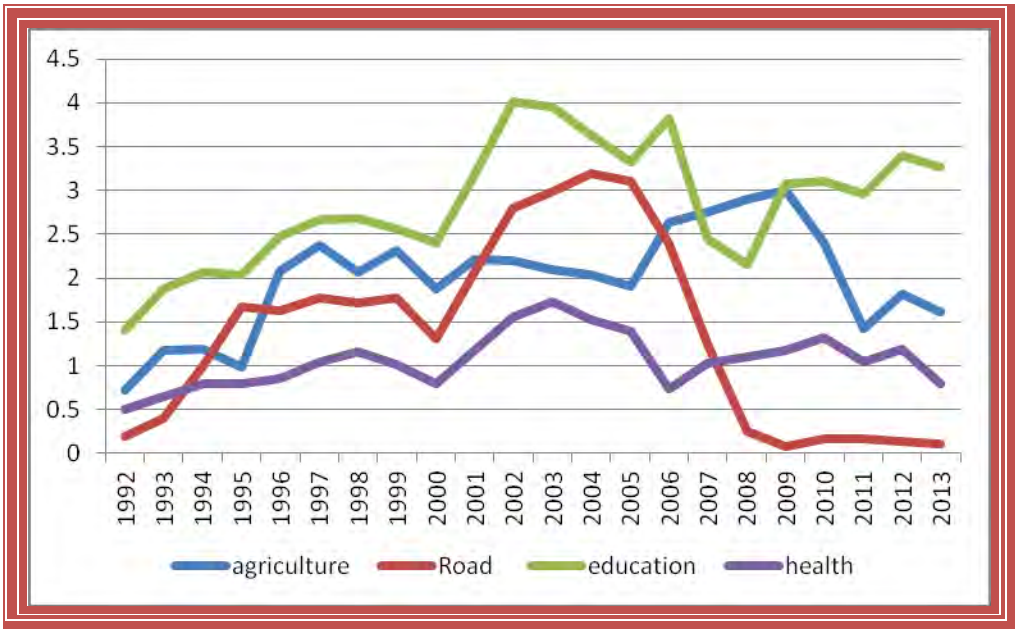
Source: Ministry of Finance and Economic cooperation (MOFEC) ,2002,2004,2006,2009,2012 20015, and World Bank (2001, 2004,2014,2016 and Various Issues) and Own Calculation

Figure 3: Percentage share of government expenditures on pro poor sectors as of total government expenditure in Ethiopia during 1992-2013



Source: Ministry of Finance and Economic cooperation (MOFEC) ,2002,,2012 20015, and World Bank ,public expenditure review(2004,2014,2016 and Various Issues) and Own Calculation

Figure 4: Percentage share of government expenditures as of GDP in Ethiopia during 1992-2013



Source: Ministry of Finance and Economic cooperation (MOFEC) ,2002,,2012 20015, and World Bank ,public expenditure review(2004,2014,2016 and Various Issues) and Own Calculation

Figure 1 and 2 above reveal that As a percentage of total expenditure, the expenditure on education was increased from 12.6% in 1992 to 20.76% in 2013, public expenditure on agriculture and health was increased from6.4% and 4.5% in 1992 to 10.26% and 5.1 % in 2013 respectively. As a percentage of total government expenditure, public expenditure on road construction accounted for 0.72% in 2013 of the total public expenditure, a decline of about one percentage point from 1992.

The main point to be drawn from Figure 3 and Figure 4 is that education is the most dominant sector from the poverty targeted spending, followed by agriculture and health while road spending is the lowest share during 1992-2013.

2.2.2 Poverty situation in Ethiopia

It is known that poverty is a multidimensional phenomenon which has economic, social and political dimensions. Therefore, there is no universally accepted definition of poverty. Poverty is the denial of choices and opportunities for better life, being unable to meet basic needs-physical (food, health care education, shelter, etc) and non-physical (participation, identity, etc), make life insecure and painful, violation of human right, dignity, productive employment, self-respect and confidence (UNDP 1997, P. 15). In addition, Sen (1985, 1987) defined poverty based on the non-monetary aspect that poverty as lack of capability to access or deprivation from education, health, safe water and sanitation.

Therefore, based on the above concepts, poverty can be defined as the lack of income and lack of access to basic education, health care, adequate nutrition, water and sanitation as well as lack of participation in political and economic decision. Moreover, from a human development perspective, poverty can be defined as the lack of capabilities to get the access or the deprivation from being literate, healthy, adequately nourished for better life.

Similar to its definition, poverty can be measured using different conceptual approaches, ranging from income, consumption, human development and a combination of some of them. These different approaches give different poverty indicators. These can be grouped as monetary and non-monetary poverty indicators. Monetary poverty indicator measures poverty in terms of monetary value using income, consumption or expenditure data. The most commonly used monetary indicators are developed by Foster, Greer, and Thorbecke and known as FGT poverty indices (Foster, Greer and Thorbecke, 1984 pp.761-766) explained below.

The headcount ratio measures the proportion of individuals or households falling below the poverty line. Poverty gap is the product of poverty incidence (the headcount ratio) and average distance between the income of the poor and the poverty line. This measures the depth of poverty. The poverty severity index measures the inequality among the poor by squaring the shortfall from the poverty line and obtaining the mean aggregate value (ibid, 1984).

The non-monetary indicators are based on the idea that poverty is associated with deprivation of certain basic needs such as education, health care ,sanitation, nutrition and water supply as well as the vulnerability to certain risks, diseases etc. This can be quantified using the Human development index and human poverty index.

Therefore, there are different dimensions and definitions of poverty and their level of importance will vary depending up on for what objective the information is required.

From such different concepts of poverty, this study focuses mainly on the definition of poverty and its indicator based upon the human development perspective. Therefore, human development index is used in this study to assess the role of public expenditure on education, health, agriculture, defence, and road construction as well as the external financing of public spending on poverty reduction in Ethiopia over the period 1992-2013. This is justified as follows: first, the data for monetary indicators such as the headcount ratio, poverty gap and poverty severity are generally carried out once every five years in Ethiopia. This creates a problem to have annual data on such indicators for a period under consideration. However, human development index is also possible to get annual data on human development index for Ethiopia from United Nation Development Programme's human development reports. It has the advantage that this poverty indicator measures the monetary and the non-monetary aspects of poverty. Second, human development is the fundamental factor and the prerequisite for development and, hence the neglect of this factor makes the poverty reduction objectives unachievable. According to Amin (2006 p.4), human development is the process of widening and enlarging the capabilities of the poor people, and also raising the well being of the people. In other words, it is the knowledge, the skills, attitudes and managerial efforts which strongly influence the accumulation of human and physical capital leading to the rise of the income level as well as the well being of the people. Hence, human development is directly and indirectly related to poverty reduction.

Third, human development index is the composite index that combines the 'means' and 'ends' indicators, and thus it is a valuable index in showing the general trend and roles of some policy measures on poverty reduction(Amin,2006 pp. 9-10).

Therefore, based on the above reasons, the human development index is used as the dependent variable to assess the role of public expenditure on poverty reduction. Human development index is a composite of three basic components of human development: longevity, knowledge and living standard. Longevity is measured by life expectancy and knowledge is measured by a combination of adult literacy and mean years of schooling. Living standard is also measured by the purchasing power based real GDP per capita. Whereas, human poverty index is a composite index measuring the deprivation of the three basic aspects of human life as reflected in human development index (UNDP, 1994 pp. 91& 163). In particular, the inclusion of the monetary component, that is, real per capita GDP in purchasing power parity dollars shows that human development index will be inversely correlated with income measure of poverty.

2.2.2.1 The trend of income poverty in Ethiopia

Different measures of income poverty such as poverty headcount ratio, poverty gap, and poverty severity are presented in table 2 below.

Table 1: trends in total poverty indices at national level

Poverty Indicator	1996	2000	2005	2010	Changes In Indices (%)				
					2000 over 1996	2005 0ver 2000	2005 over 1996	2010 Over 2005	2010 Over 1996
Poverty headcount ratio	0.455	0.442	0.387	0.296	-2.7	-12.4	-14.8	-23.51	-34.95
Poverty gap	0.129	0.119	0.083	0.078	-7.7	-30.0	-35.4	-6.02	-39.53
Poverty severity	0.051	0.045	0.027	0.031	-12.2	-39.8	-47.1	14.81	-39.22

Source: Ministry of Finance and Economic Development (MOFEC), 2012. And own calculation

As we have seen in the Table 2 above, the trend of income poverty in terms of poverty headcount ratio, and poverty gap in 2010 have declined by 23.5% and 6% respectively, while poverty severity indexs in 2010 has been increased by 14.8% from their levels in 2005.when we compare those indices from 1996, poverty headcount, poverty gap and poverty severity indices have been declined by 35%, 39.5% and 39.2% respectively,

2.2.2.2 Trends in non-monetary dimension of poverty

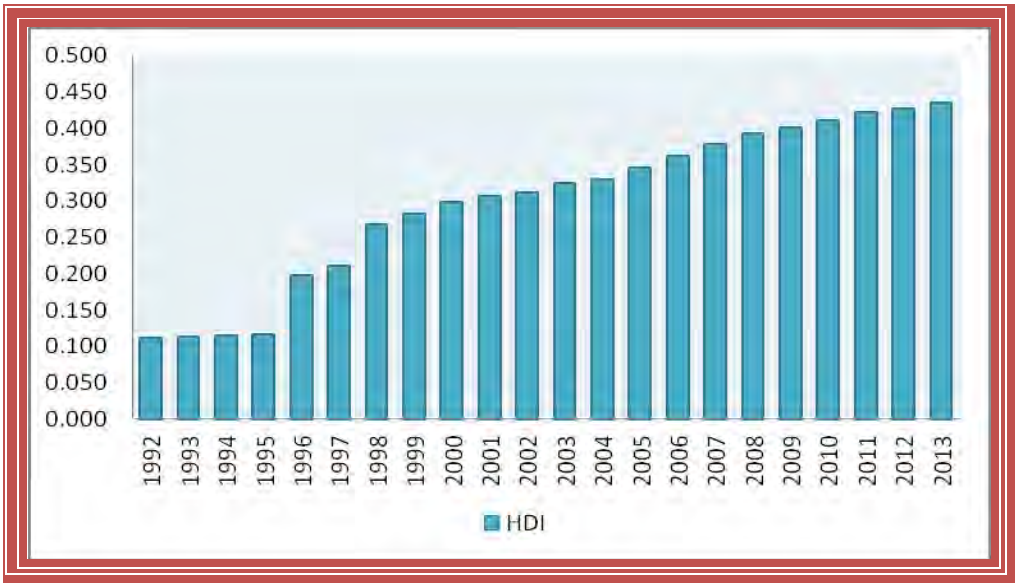
Non-monetary indicators of poverty are summarised in Table 3 and Figure 4 below. These include life expectancy at birth, literacy rate, access to health, access to safe water, and underweight. As indicated in Table 3 below, all these indicators have shown a small progress during the 16 years period ending 2014.

Table 2; trends in selected welfare indicators at the national level of Ethiopia

indicators	1996	1998	2000	2002	2004	2006	2008	2010	2012	2013 over 1996
life expectancy at birth	49.8	50.8	51.9	53.4	55.3	57.3	59.5	61.3	62.8	26
Mortality rate, neonatal (per 1,000 live births)	53.2	50.5	48.4	45.9	42.7	39	35.5	32.5	30.4	-43
Mortality rate, under-5 (per 1,000 live births)	168.3	156.2	145.1	132.2	117	101.3	86.9	75.7	67.7	-60
maternal mortality ratio(per 100000 birth lives)	1040	959	897	846	780	698	608	523	447	-57
Literacy rate	26	27	29		38	29.8	35.9	35.9	35.9	38
Access to safe drinking water	19	24	28	22	36	40	48	50	54	184
Human development index	0.198	0.268	0.298	0.311	0.329	0.362	0.393	0.411	0.427	116

SOURCE: Ministry of Finance and economic Development (MOFED, 2006; PP32-33), and United Nation Development Programme (UNDP) various reports

Figure 5: the The Human Development Index of Ethiopia 1992-2013



Source; HUMAN DEVELOPMENT REPORTS,UNDP(1996,1999,2002,2005,2008,2011,2014)

At the national level, literacy rate increased from 26% in 1996 to 385.9 % in 2012. Access to health services also increased from 45% in 1996 to 65% in 2004. In addition, the neonatal, under 5 and maternal mortality rates declined by more than 43 % in 2012 from their values in 1996.. Moreover, percentage of people with access to safe drinking water sources has shown an increment from 19% in 1996 to 54% in 2012. As shown in the Figure 5 above, human development index increased by 116% from its level in 1996, whereas, the poverty situation indicated by human poverty index declined by 0.7% from its level in 1996.

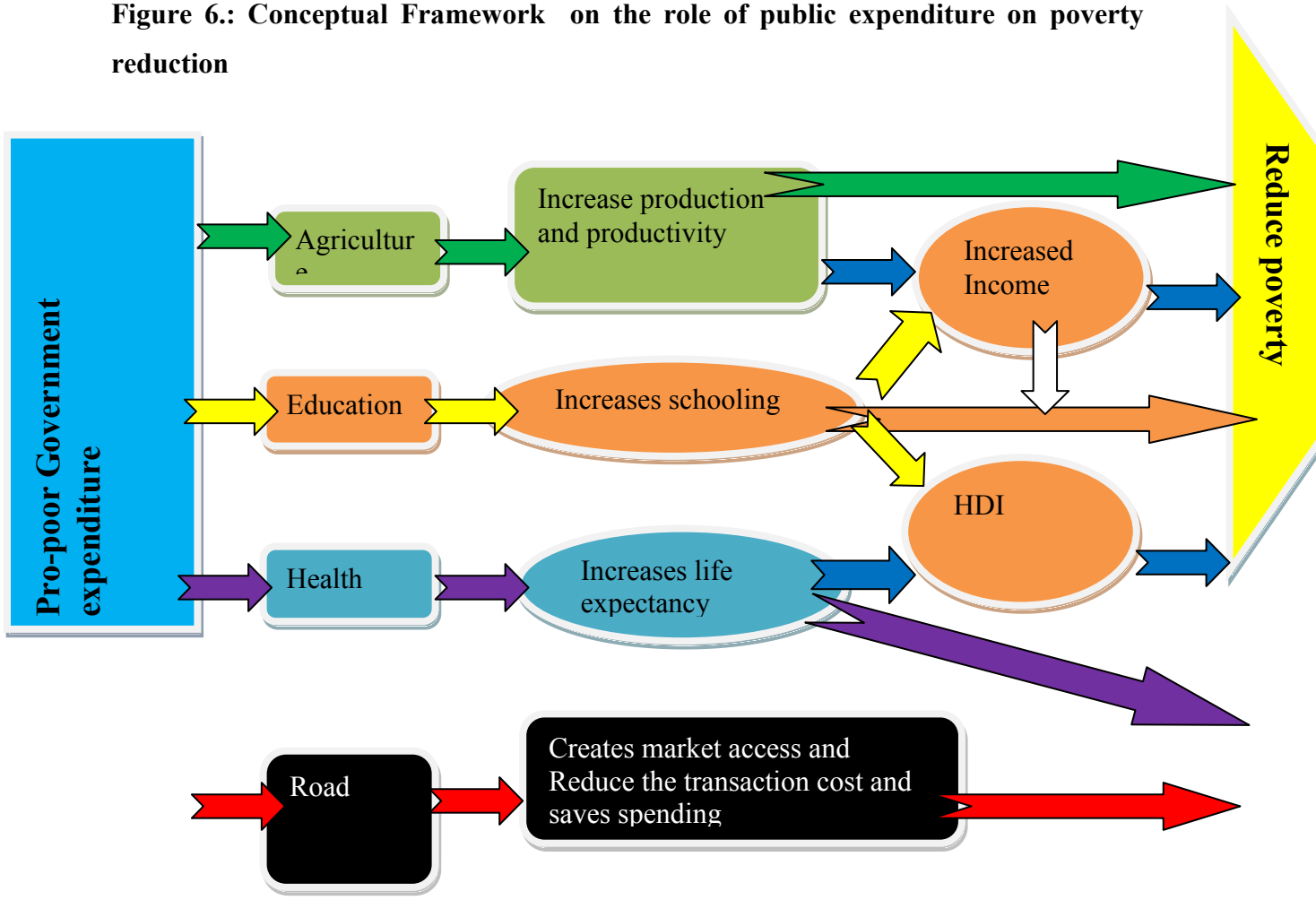
2.3. Conceptual Framework

Public expenditure can affect poverty reduction in different ways; some of these are direct and others are indirect. Public expenditure can directly reduce poverty mainly by the provision of basic goods and services such as education and health services, income transfers and food aid. Thus, public provision of goods and services can increase the empowerment and the income of the poor, and reduce the marginalization of poor people. On the other hand, public expenditures can indirectly influence poverty reduction via

enhancing growth. Public expenditure on social services has also indirect roles on poverty reduction by boosting growth in the long run. Hence, the indirect roles of public expenditures are mainly reflected through the growth of the economy. Therefore, factors that determine the growth of the economy such as trade, private and public investments, macroeconomic policies etc have an indirect and long run effects on poverty reduction. For instance, public expenditure on infrastructures such as road construction, electricity, telecommunication etc, human capital development, and agricultural research and development reduce poverty by creating employment opportunities for the poor in the short and medium term, but would probably have long run linkage effects on the rest of the economy. Given the available data, these long term linkage roles of public expenditures on poverty reduction are difficult to model in detail in this study.

This study focuses on analysing the role of public expenditure on pro poor sectors like education, health, agriculture and road as well as the Gross domestic Product which is the proxy measure of income. Therefore, to illustrate their roles on poverty reduction in Ethiopia in the period 1992-2013, I use the following conceptual framework.(see figure 1 below). This figure shows the linkage between the poverty and public expenditure in the context of income growth. In this study, framework was constructed to help build understanding related public expenditure analysis according to the area context, data availability, and issues analysis. The study concentrated on public expenditure on roads, health, agriculture and education to support the growth of per capita income which leads to poverty reduction. To understand how the government expenditure on pro poor sectors affects rural income and poverty reduction,

Figure 6.: Conceptual Framework on the role of public expenditure on poverty reduction



Source-adapted from literature review

Government spending is driven by the objective to positively affect poverty reduction directly and indirectly through income as a result of reduced cost of agriculture inputs and outputs and increased production of farms and non-farms activities. To achieve its effect in poverty reduction, the government spending works to pro poor sectors that result in income growth. Afterward, the income growth could have direct effects in the same directions with poverty reduction (see figure 1).

On the other hand, public expenditure on agriculture, education, health and roads, directly influences the production of farm and non-farms activities. Improved roads reduce transaction cost for both agriculture input and output. Public expenditure on roads

directly reduce the cost of transaction and reducing food prices in all kinds of opportunities, thereby directly saves spending and thereby improving or rising income and reducing poverty. Health and education are very important determinants of poverty. Educated and healthy masses have more opportunities for better employment that increases their earnings and helps in raising their living standard, life expectancy and schooling. Education and health are considered to be the most important way to build human capital and then improving human development and thereby eradicate poverty by enhancing productivity.

CHAPTER THREE

3 Research Methodology

3.1 Data set, source and Specification of variables

The data set for this paper consists of annual time series on Ethiopia for a 22 year period starting from 1992 to 2013. The principal variables comprise per capita government expenditure on education (GE), per capita government expenditure on health (PCEH), per capita expenditure on agriculture (PLEAA), per capita expenditure on road construction (PCER), and per capita real gross domestic product(PCGDP).. Each per capita expenditure variables and per capita gross domestic product variable is measured in terms of the local currency, i.e. Ethiopian Birr. While the dependent variable; human development index is a unit less variable.

Secondary data sources were used from various surveys and reports of Ministry of Finance and Economic Development of Ethiopia (MOFEC), World Bank, United Nation Development Programme, and other organisations' publications. In particular, data on public expenditures are taken from MOFEC and World Bank public expenditure reviews. While the poverty indicators such as human development index and human poverty index are extracted from the UNDP's human development reports. Therefore, I compile these data sets based on the availability and their use in different model. However, long time series data on poverty headcount, poverty gap and poverty severity is not available at country level. Hence, I use other type of poverty indicator, i.e. human development index as a dependent variable for assessing the role of public expenditures on poverty reduction.

3.2 Model structure

The conceptual approach considered the poverty reduction as a function of public expenditure on education, health, agriculture, and road construction, and also per capita income. In particular, the degree to which type of expenditure has a stronger poverty reduction effect was analysed, given the domestic financing of the government expenditure.

The instrumental approach is an analysis of the relative role of education, health, agriculture, and road construction expenditures, and per capita income on poverty reduction at the national level data of Ethiopia during the period 1992-2006. Pro-poor public expenditure role assessment may be influenced by approaches, methods and indicators employed for estimation. Here, the tools and techniques were reviewed by the previous studies to assess the public expenditure role on poverty.

A-REDUCED FORM REGRESSIONS

This model typically uses single country time series data or cross country time series data to test the statistical relationship between components of public spending and poverty reduction. The robustness of the results of this regression is often sensitive to empirical strategy employed and the time period covered by the sample.

Foster and Szekely (2001) and Dollar and Kraay (2002) use aggregate and micro cross country data respectively to estimate the link between public spending and poverty by using this model. Based on their analysis, they conclude that government expenditures have a statistically significant effect on poverty.

B-GENERAL EQUILIBRIUM MODEL

Computable general equilibrium models form a class of models where production activities, factors and institutions and their link are fully specified. These require both national accounts and survey data. The data also must be compiled into a single information matrix where the link between activities, factors and institutions are organised using country specific parameters. This model is rarely used by some researchers, because it requires high technical ability and intensive data.

C-Investment Appraisal

Some researchers advocate this approach (For example Devarajan et al., 1995). In particular, Larsen and Rama (2003) present two practical ways of assessing the poverty role of investment projects. These are the project approach, which estimates the rate of

return and then calculating the poverty reducing effects of the project, and the statistical approach, which uses statistical information on the local poverty role associated with local investment. Both approaches estimate the poverty role of investments, however, these approaches have some limitations, in particular, the project approach considers only direct effects of projects and the statistical approach considers only the local effects but they ignore indirect effects or externalities and network effects or transmitted effects, respectively.

D-Incidence Analysis

Cross country regressions and CGE models establish the link between the expenditure components and poverty reduction in very broad terms. However, incidence analysis assesses the correlation between spending components and poverty reduction to a very limited extent (see Lanjauw and Ravallion, 1995).

E-Other Tools

Service delivery and household survey assess the efficiency of service provision, and allocate additional spending in the provision of services

Having such evidences and concepts, this study adapts and develops an econometric model to estimate the effects of public expenditures on poverty reduction. The analysis focuses on the role of poverty targeted sectors such as education, health, agriculture and road construction expenditures on the poverty reduction. Therefore, to achieve this objective, I adapt the reduced form model which is developed by Ferrori and Kanbur (1992) but with some modifications allowing a choice among public expenditure, and identifying human development index (HDI) as the dependent variable.

Therefore, human development index (HDI) is a function of per capita public spending on education (PCEE), health (PCEH), agriculture (PCEA) , road construction(PCER), and per capita gross domestic product(Y)) and I assume that public expenditure in education, health, agriculture and road construction are directly related to Human development index; that is

$HDI = f\,(Y, PCEA, PCEE, PCEH, PCER,)$………………………………….. … (1)

$HDI_t = \beta_0 + \beta_1 Y_t + \beta_2\, PCEA_t + \beta_3\, PCEE_t + \beta_4\, PCEH_t + \beta_5\, PCER$…… ………………………..(2)

The reduced form in equation 1 may at most gives an estimate of the effect of variables on poverty reduction. If there is any serial correlation problem, a reduced form equation is inappropriate and a different estimation procedure is required for the model. For this reason, I prefer not to use a reduced form equation as in equation 2. Instead I use a double-log functional form of equation 3 below. In addition, adding an intercept and error term to equation (3) gives a general econometric model. Therefore, the model to investigate the extent to which the per capita government expenditure on education, health, agriculture, road construction, and defence as well as per capita real Gross domestic product and per capita external financing have an role on poverty levels can be outlined as follows.

$In(HDI_t) = \beta_0 + \beta_1 In(Y_t) + \beta_2 In(PCEE_t) + \beta_3 In(PCEH_t) + \beta_4 In(PCEA) + \beta_5 In(PCER) + U_t$

…………………….. *(3)*

Where In-natural logarithm

HDI is human development index is a measure of Poverty.

β_0 is a constant or intercept

β_1 elasticity of per capita real GDP

β_i (i stands for 2,3 ,4, and 5, are coefficients of per capita government expenditures(or the elasticity's of government expenditures)

β_7 is coefficient of external public financing

Y is a per capita GDP in Ethiopian Birr (to capture the effect of other public expenditures)

PCEE Per capita government expenditure on education in Ethiopian Birr

PCEH Per capita government expenditure on health in Ethiopian Birr

PCEA Per capita government expenditure on agriculture in Ethiopian Birr

PCER Per capita government expenditure on road construction in Ethiopian Birr

U error term

t time series data, referring year starting from 1992 to 2013

In my analysis, I will focus on estimation of elasticity of poverty with respect to per capita public expenditures. In this respect, I transform poverty indicator and each government spending category in logarithm. Parameter estimates gives the magnitude of elasticity of poverty reduction with respect to per capita public expenditure in education, health, agriculture, and road construction. The larger the absolute size of this elasticity, the more responsive is poverty reduction to the corresponding public expenditure.

Hypothesis of the Study

In order to meet the objectives of the study the following hypothesis was tested:

HO: Government expenditure on pro poor sectors has no role on poverty reduction

H1: Government expenditure on pro poor sectors has role on poverty reduction

3.3 Model estimation approach

To assess the role of public expenditure on poverty reduction using a time series variables mentioned above, a co-integration regression model has been used. Co-integration techniques are important techniques in analysing time series data, because it assists us in determining the long run equilibrium relationships between time series variables. To establish a long-run equilibrium between time series variables, each time series variables included in the study should be integrated in the same order, and have a stationary linear combination.

Therefore, before estimating the magnitude of the parameters, it is necessary to perform stationary and unit root tests. This is due to the reason that most time series data have non-stationary problem, and thus regressing non-stationary series will yield spurious results. In addition, it is difficult to establish the long-run relationships between variables.

A unit root test is used to know whether the variable shows similar statistical properties like mean reversion characteristics, finite variance, transitory shocks, and thereby determining the order of integration. In other words, the unit root test finds out which variables are integrated in the same order.

Several studies suggested a number of co-integration techniques including Engle and Granger (1987) and Johansen (1988). Even though the Johansen's approach has the advantage of testing the co-integration of the variables of the system in one step, and also do not require the prior assumption of endogeneity or exogeneity of the variables, it needs long time series data to perform the test of integration while the Engle and Granger approach allows the testing of co-integration using short time series data. Since the time series data included in this study are relatively short, and the quality of the data is less than ideal due to inconsistency, I could not use the Johansen's approach. Instead I adopt the Engle and Granger approach.

So, having the concept of Engle and Granger approach, the order of integration of the individual variables were conducted by conducting tests for stationary. According to Engle and Granger (1987), non-stationary variable is said to be integrated of the order d if it can be made stationary by differencing it d times. So, this approach requires two steps to test the order of integration. The first step is estimating the best possible linear equation and saving the residuals. The second step is conducting a unit root test whether the residuals are stationary or not. If the residuals are stationary, then the long-run equilibrium relationship is said to be exist.

Hence, the stationary properties and the existence of unit roots in the time series are proved by conducting the Augmented Dickey-fuller (ADF) test. This test is carried out on the variables in level, first and second differences. After establishing the same order of

integration between variables, I run an ordinary least square regression of the variables on levels. All tests and estimations have been analysed with Eview version 9

CHAPTER FOUR

4 Presentation, Analysis and Discussion

Regressing non-stationary variables can lead to spurious results, and thereby leading false conclusion. Therefore, before proceeding with the estimation of the model, some preliminary tests were carried out. So, this chapter has two parts. In the first part, the preliminary tests and the co-integration test were presented below.

4.1 Preliminary tests

Time Series Properties of the Data

Before estimating the role of per capita government expenditure on agriculture, education, health and road, and per capita GDP on poverty reduction, transformation of the data into logarithmic form was carried out to establish the normality and stationary of the variables. Descriptive statistics for the data were taken for variables if residual (ε) follows normality.

Table 3 Descriptive Statistics for Variables in levels

Descriptive Statistics	LHDI	LPCEA	LPCEE	LPCEH	LPCER	LPCGDP
Mean	-1.30	3.65	4.00	3.02	3.30	7.45
Median	-1.15	3.37	3.76	2.95	3.51	7.13
Maximum	-0.83	5.28	5.99	4.80	4.54	9.21
Minimum	-2.19	1.68	2.68	1.33	0.34	6.41
Std. Dev.	0.47	1.05	1.01	1.02	1.08	0.84
Skewness	-1.03	0.12	0.62	0.33	-1.18	0.81
Kurtosis	2.63	2.01	2.24	2.08	4.03	2.39
Jarque-Bera	3.99	0.95	1.93	1.18	6.08	2.72
Probability	0.14	0.62	0.38	0.55	0.05	0.26
Sum	-28.56	80.40	87.92	66.49	72.55	163.94
Sum Sq. Dev.	4.61	23.21	21.21	21.91	24.38	14.80
Observations	22.00	22.00	22.00	22.00	22.00	22.00

Source: Eviews 9 output, own calculations

From the Table 3, Positive kurtosis indicates heavy tails and peaked relative to the normal distribution. A zero skewness value indicates that the values are relatively evenly distributed on both sides of the mean, typically (but not necessarily) implying a symmetric distribution. Since the distribution is symmetric then the mean is equal to the median and the distribution has close to zero skewness. According to data available in table 4,the data variables follow normal distribution, since the normal distribution has a skewness of zero.

A. Test of correlation

The results in table 4 below reveal that, the log value of the per capita government expenditures on education and health are strongly correlated. Similarly for the log value of the per capita government expenditures on education and per capital GDP have correlation. In general, all variables show positive strong correlation to each other. This indicates that, the per capita government expenditure on roads, education, health, agriculture and per capita GDP have positive correlation. Therefore we can conclude that for government expenditure to have a positive role on reducing poverty has to spend to pro poor sectors and has to increase the per capita income of the poor people in the country.

Table 4: Correlation matrix

variable	LHDI	LPCEA	LPCEE	LPCEH	LPCER	LPCGDP
LHDI	1.00	0.88	0.82	0.85	0.91	0.76
LPCEA	0.88	1.00	0.95	0.98	0.90	0.95
LPCEE	0.82	0.95	1.00	0.99	0.85	0.99
LPCEH	0.85	0.98	0.99	1.00	0.90	0.98
LPCER	0.91	0.90	0.85	0.90	1.00	0.81
LPCGDP	0.76	0.95	0.99	0.98	0.81	1.00

Source: Eviews 9 output, own calculations

On the other hand, According to Gujarati (2005), with the number of 22 observations, if the correlation coefficient is higher than 0.8, we face a multicollinearity problem. Based on this evidence, we can see that there is mullticollinearity problem between almost all variables. This might be due to the non-stationary of the series under consideration. So, before correcting this problem, the non-stationary test and graphical presentation of the variables should be checked. If the series are a trend non-stationary, we can solve the problem of multicollinearity by first differencing or de-trending the variables.

B-TEST FOR STATIONARITY

Time series econometric analysis is not complete without conducting stationary test on variables in the study. As mentioned in the introduction, running a regression on non stationary series data produces spurious results with the risk of misleading interpretation. Non stationary series do not have finite mean, and variance over time (Gujarati, 2005). Therefore, all series must first be checked for stationary. Currently, there are many techniques to test the stationary of time series variables. Among these test, the unit root test is widely used as a formal statistical test. The augmented Dickey-Fuller test is the most commonly used technique to test the unit root. To apply this test, it is important to consider the following equation.

$$Y_t=\alpha+\rho Y_{t-1}+U_t \quad \text{.....4}$$

The time series Y is considered stationary if ρ lies strictly between -1 and 1. But if the absolute value of ρ is greater or equal to one, the variable is non-stationary. Based on this equation, the null hypothesis (Ho) of the unit root test is that the series has a unit root.

$$H0: \rho=1$$

This test has the following procedure:

$$D(Y_t)=\alpha+\delta Y_{t-1}+U_t \quad \text{.....5}$$

Where D is the difference operator and δ=ρ-1.Hence, the null hypothesis for the unit root test in this equation is that H0: δ=0

To say that the series is stationary, the absolute value of ρ should not exceed one, or to put differently, the coefficient of δ must be negative with the corresponding ADF t-statistic being related to the appropriate critical value. If the absolute value of t-staitics more than the critical value ,we reject the null hypothesis,i.e. and the probability is less than 10%.The coefficient of the variable after the test should be negative otherwise we should not use it in the model

Having these concepts and these preconditions, the Augmented Dickey-Fuller test is applied on individual time series to make sure the series has no a unit root and thus the series is stationary. Therefore, Table 6 reports the results of the unit root test that allow for a time trend.

Table 5: Unit root tests

The Augmented Dickey-Fuller test (ADF			
series	**Trend and constant**		
	Level	**First difference**	**Second difference**
In HDI	-0.38	11.66***	-3.13
In PECA	-2.18	-3.15	-5.13***
In PCEE	-0.18	-3.09	-5.11***
In PCEH	-1.42	--3.57	-6.13***
In PCER	-5.68***	-2.35	-5.45***
In PCGDP	0.47	3.37	--6.10***

Source: Eviews 9 output, own calculations

***** _denotes significant at 1%, **_denotes significant at 5% * _denotes significant at 10% and**

The Augmented Dickey-Fuller (ADF) test shows for all indices except LPCER that the level data was non-stationary; however all indices are stationary after the second difference. This means all of our data is integrated of order one, I (2),at the 1% significance level for the 22 sample periods, The test also reveals that all variables are not stationary first order differences with trend and intercept except LHDI..

With intercept and trend, Table 5 also shows that the all variables except LPCER are not stationary at all Mackinnon critical value at level. To verify that the order of integration is I (1), the presence of a unit root in the first and the second difference of the variable indices were also tested. The tests show that there is a unit root in each series except LHDI in the first difference but in the second difference, each series has no unit roots problem.

Based on the result of ADF test presented in Table 5, it is possible to conclude as follows. First, all variables have no the same order of stationary at log levels and log first difference. Second, the variables are also time trended. Third, the second differencing of the variables is almost stationary at 1% Mackinnon critical value. Therefore, de-trending the series makes the variables stationary.

C-Serial correlation test and hetroscedasticity test

In time series studies, the assumption that errors corresponding to different observation are uncorrelated is often violated. This problem is said to be serial correlation. Serial correlation does not affect the unbiasedness and consistency of the ordinary least square regression estimators, but it affects their efficiency. Therefore, it makes one to give misleading conclusions. Hence, before conducting other estimations, it is vital to check whether the residual of the regression is serially correlated or not by using serial correlation test techniques.

By far the most popular test for serial correlation is the Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) Test. Under this test, the null hypothesis is that there is no evidence for serial correlation up to order 'L' using appropriate Chi-square or F-statistic. For this study, I employ the Breusch-Godfrey Serial Correlation LM Test. To apply this test, I follow two steps below.

First, the ordinary least squares were regressed to obtain the estimated residuals for all-time series included in this study. Second; Using Eviews,9 and then residual based LM

test for the null hypothesis were conducted that there is no serial correlation up to order one. Based on these steps, the results of this test is presented in table 7a and 7b below

Table 6a: Serial correlation test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.796075	Prob. F(2,14)	0.4705
Obs*R-squared	2.246469	Prob. Chi-Square(2)	0.3252

Source: Eviews 9 output, and own calculations

Based on this test result in table 6a above, we do not reject the null hypothesis of no serial correlation in this model. In other words, it shows that there is an evidence for no serial correlation, because the Obs*R-squared is greater than the p-value and the p values of f-stat and obs*R-squared are greater than 5% significance level.

Regarding the hetroscedasticity test, There are two main types of tests: these are; Tests for continuous changes in variance: White and Breusch–Pagan tests and Tests for discrete (lumpy) changes in variance: the Goldfeld–Quandt test. The White test for heteroskedasticity has a basic premise: if disturbances are homoskedastic, then squared errors are on average roughly constant. Explanators should not be able to predict squared errors, or their proxy, squared residuals. The White test is the most general test for heteroskedasticity.

Hence the white test was used to check the hetroscedasticity problem based on the following steps.

- Five Steps of the White Test:
    1. Regress *Y* against your various explanators using OLS

2. Compute the OLS residuals, $e_1 ... e_n$
3. Regress e_i^2 against a constant, all of the explanators, the squares of the explanators, and all possible interactions between the explanators (p slopes total)
4. Compute R^2 from the "auxilliary equation" in step 3
5. Compare nR^2 to the critical value from the Chi-squared distribution with p degrees of freedom.

Having these steps, using eviews 9 and the result is revealed were checked as follows on Table 7b below

6b-Heteroskedasticity Test: White

7b-Heteroskedasticity Test: White			
F-statistic	11.21741	Prob. F(20,1)	0.2317
Obs*R-squared	21.90237	Prob. Chi-Square(20)	0.3458
Scaled explained SS	6.971057	Prob. Chi-Square(20)	0.9968
R-squared	0.995562	Mean dependent var	0.009374
Adjusted R-squared	0.906811	S.D. dependent var	0.010526
S.E. of regression	0.003213	Akaike info criterion	-9.824997
Sum squared resid	1.03E-05	Schwarz criterion	-8.783547
Log likelihood	129.0750	Hannan-Quinn criter.	-9.579662
F-statistic	11.21741	Durbin-Watson stat	3.211019
Prob(F-statistic)	0.231656		

Source eviews 9 output

From the table 6b above, we can say that we do not have an evidence to reject the null hypothesis of homoscedasticity. Because the obs*R value is less than the p value i.e 34%. So, the homoscedasticity model gives unbiased standard errors, because standard error is central to conduct significance testing and calculating confidence intervals. Therefore, unbiased standard error leads to correct conclusions.

Homoscedasticity describes a situation in which the error term (that is, the "noise" or random disturbance in the relationship between the independent variables and the dependent variable) is the same across all values of the independent variables.

Table 6a and 6b reveal that there is an evidence for no serial correlation and no hetroscedasticity, therefore, we can use the model for hypothesis testing and forecasting. the next step is testing whether the linear combination of variables including the trend variable has the static or long run relationship. This can be verified by using co-integration test.

D. Lag length selection in Vector Auto-regression (VAR) model

Vector Auto-Regression (VAR) in an econometric model has been used primarily in macroeconomics to capture the relationship and independencies between important economic variables. The VAR can be considered as a means of conducting causality tests, or more specifically Granger causality tests.

Before running the co-integration test, the selection of lag length should be done first. In selecting lag-length for VAR model, a critical element in the specification of VAR models is used. Various lag length selection criteria are defined by different authors like, final prediction error (FPE), Akaike Information Criterion (AIC) suggested by Akaike (1974), Schwartz Criterion (SC) (1978) and Hannan-Quinn Information Criterion (HQ) (1979). These criteria mainly indicate the goodness of fit of models.

Table 7 Lag length selection in Vector Auto-regression (VAR) model

VAR Lag Order Selection criteria						
Endogenous variables: LHDI LPCEA LPCEE LPCEH LPCER PCGDP						
lag	LogL	LR	FPE	AIC	SC	HQ
0	35.45	NA	1.82E-09	-3.100019	-2.801775	-3.049544
1	159.32	156.4732	2.17E-13	-12.34998	-10.26227	-11.99665
2	287.31	80.83426*	6.80e-17*	-22.03288	-18.15571	-21.37671
3	2935.38	0	NA	-296.9874*	-291.3207*	-296.0284*
*** indicates lag order selected by the criterion**						

From the results of VAR lag order selection criteria in table 8 the lag length of 3 for the granger causality test was used. This is due to the fact that Akaike Information Criterion Schwartz Bayesian Criterion and Hannan-Quinn Criterion choose 3 lags whereas the LR and FPE criterion choose 2 lags.. The use the VAR lag length was chosen from the best maximum lag length selection of variables by the criterion, which minimized the values of the respective information criteria. Therefore, lag order 3 chosen by The Akaike information criterion selects was used in this study. After selection of lag length of the variables, cointegration test was conducted by the coefficient of lagged error correction model (EC1) through vector error correction model to determine the long run relationship of the variables.

4.2 Co-integration test

Individual time series data might be non-stationary but a linear combination of them might be stationary. This kind of combination is said to be co-integration. Hence the result of a co-integrating regression is not spurious. Moreover, it is possible to take the co-integrating regression model as the static or long run poverty reduction function and interpret its parameters as long run parameters (Gujarati, 2005; p. 824).

There are several ways of testing for co-integration. The tests can be categorised into two broad categories: those that are residual based, such as the Engle-Granger approach and those that are based on maximum likelihood estimation on a VAR system, such as the VECM. Co-integration analyses are designed to find linear combinations of variables that also remove unit roots. The VECM approach test used to deal with problems of co-integration (variables have a long-term or equilibrium relationship between them).

In this study, the coefficient on the error correction term (EC1) used to test for co-integration. The error correction term tells us the speed with which variables returns to it should be negatively signed, indicating a move back towards equilibrium and a positive sign indicates movement away from equilibrium. The coefficient should lie between 0 and 1, 0 suggesting no adjustment one time period later, 1 indicates full adjustment. Furthermore, the error correction term can be either the difference between the dependent or explanatory variable. Then, co-integration test is performed by the coefficient of lagged error correction model (EC1) through Vector error correction model to determine the long run relationship of the variables. The error correction mechanism measures the distance of the system away from equilibrium. The coefficient of ECMt-1 should be negative in sign in order for the system to converge to equilibrium.

One of the most popular techniques in recent years for testing the order of integration is the Engle -Granger (EG) or Augmented Engle-Granger (AEG) test. This technique requires two steps to test the co-integration. First, it is necessary to estimate the best possible linear equation, and then residuals are collected (saved). Second, a unit root test

is carried out to test the stationary of the residuals. If the residuals are stationary, then a long run equilibrium relationship is said to exist.

The first step of co-integration test process can be written as follow;

$Yt=\alpha_0+ \alpha_1 Xt+Ut$……..6

Find out the OLS estimates of α_0 and α_1, and calculate from them the estimated residuals, $\hat{u}_t$ as follows

$\hat{u}_t= Yt- \bar{\alpha}_0- \bar{\alpha}_1 Xt$……7

Where Variable Y as a dependent variable and X as an independent variable

Ut is the residual

If the residual Ut is stationary, the two time series Y and X are said to be co-integrated and thus they have long run equilibrium relationship.

The second step is conducting a unit root test on Ut by using ADF test technique. The results of this test are presented below.

$U_t=\rho U_{t-1}+e_t$……..8

$D(\hat{u}_t)=\delta \hat{u}_{t-1}+ e_t$ ……9

Where D is the difference operator and $\delta=\rho-1$. In addition, the above equation 8 and equation 9 should not include the trend or intercept, because the residual must have a zero mean so as to have a stochastic trend.

Hence, the null hypothesis for the unit root test in this equation is that H0: $\delta=0$ against H1: $\delta>0$ using ADF critical values. In other words, the null hypothesis of co-integrating test is that the series examined by the residual of the co-integrating regression is not stationary.

Having the concepts and steps how to do it, the ADF unit root test on the residual of co-integrating regression at log level and difference form were employed. Based on the ADF unit root test at level and none, the result is displayed as follows in table below.

Table 8- the long run model

Dependent Variable: LHDI
Method: Least Squares
Date: 05/24/17 Time: 21:50
Sample: 1992 2013
Included observations: 22

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPCEA	0.689278	0.134093	5.140305	0.0001
LPCEE	1.427198	0.314720	4.534813	0.0003
LPCEH	-0.153882	0.320374	-0.480322	0.6375
LPCER	0.017534	0.086983	-0.201583	0.0028
LPCGDP	-1.889633	0.306287	-6.169492	0.0000
C	5.083024	1.336273	3.803882	0.0016

R-squared	0.955241	Mean dependent var	-1.298374
Adjusted R-squared	0.941254	S.D. dependent var	0.468420
S.E. of regression	0.113533	Akaike info criterion	-1.286441
Sum squared resid	0.206237	Schwarz criterion	-0.988884
Log likelihood	20.15085	Hannan-Quinn criter.	-1.216345
F-statistic	68.29468	Durbin-Watson stat	1.420457
Prob(F-statistic)	0.000000		

Source;Eviews 9 result

Table 8 above shows the stationary of residual (U) obtained from the estimation of equation 3 or 6 at level as shown by ADF test with null hypothesis U has a unit root.as the Durban Watson value 1.42 which is greater than the value of R-squared ,i.e 0.96 and close to 2. we can say that the long run static equation is not spurious because more than 50% of the variables are statistically significant and explained 96% of the dependent variable.

Table 9 Co-integration test of model one using **ADF test of residual of long run static equation**

Null Hypothesis: residul has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.323477	0.0021
Test critical values:	1% level	-2.679735	
	5% level	-1.958088	
	10% level	-1.607830	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(Resid)
Method: Least Squares
Date: 05/24/17 Time: 21:59
Sample (adjusted): 1993 2013
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Resid(-1)	-0.735604	0.221336	-3.323477	0.0034

R-squared	0.355489	Mean dependent var	0.002528
Adjusted R-squared	0.355489	S.D. dependent var	0.120999
S.E. of regression	0.097140	Akaike info criterion	-1.778880
Sum squared resid	0.188723	Schwarz criterion	-1.729141
Log likelihood	19.67824	Hannan-Quinn criter.	-1.768086
Durbin-Watson stat	1.847635		

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

Source: Eviews 9 output, own calculations

If the Durban Watson test value 1.85 is close to 2 and if the Absolute value of t-statistic is greater than the absolute values of critical values ,then we reject the null hypothesis of unit root (non-stationery) and we do accept the alternative hypothesis of no unit root(stationary).so we can say that the variables have long run co-integration.

Table 9 also reveals that the absolute value of t-statistics is greater than the critical value at 1%,5% and 10% ,we reject the null hypothesis, of unit root and we do accept the alternative hypothesis of no unit root in the residual at level means that the series are stationary, Thereby there is co integration at level. In addition, the coefficient of the per capita public pro poor expenditures on agriculture, and education and per capita GDP are consistent with economic theory as well as all of the variables except LPCEA,LPCEE and LPCGDP in the model are statistically significant at 1% significance level, others are not statistically significant.

Table-9 above shows that the Durban Watson is 1.85 which is close to 2 and the absolute value of t-statistics is 3.32 which is greater than the absolute critical value of 2.68 at 1%, 1.96 at 5% and 1.6 at 10% significance levels, therefore, we do not fail to reject the null hypothesis of unit root (non-stationary) but we can accept the alternative hypothesis of no unit root (stationary).Therefore, we can conclude that the variables are co-integrated in the long run.Then the next step is estimating the error correction because the variables are co-integrated. If it is not co integrated, we do not proceed to estimate vector error correction model, we simply estimate the VAR.

Co-integration and non-spurious regression are the fundamental requirements of Error Correction Model. (ECM) Results of co-integration test Table 9 provide enough evidence on the long run relationship between the variables under consideration as there are two co-integration equations. Result of ADF test provides enough evidence of stationary of residual table 10 at level. Both these two conditions have proved that the variables included in this study are co-integrated and non-spurious and formed a basis to estimate ECM (equation 3 or 6).

After testing for Co-integration and selecting the best model as above, we proceed to estimate an error correcting model using eviews 9 as follows. The error correction model also known as the dynamics of adjustment are estimated using the first differences of the data series and the lag of the equilibrium error using equation 10 below The results of ECM are given in Table 11 using the equation below

D(hdi)=c+b1d(lPCEA)+b2d(LPCEE)+b3d(LPCEH)+b4d(LPCER)+b5d(LPCGDP)+ b6dU(-1))+e……10

Table 10` Results of OLS parameter estimation in first difference(the short run and long run equilibrium)

Dependent Variable: D(LHDI-1)				
Method: Least Squares				
Date: 05/17/17 Time: 16:42				
Sample (adjusted): 1994 2013				
Included observations: 20 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.165389	0.069761	2.370805	0.0339
D(RESID02(-1))	-0.236613	0.248326	-0.952832	0.0081
D(LPCEA)	0.180280	0.195210	0.923518	0.0017
D(LPCEE)	0.051221	0.320819	-0.159658	0.0056
D(LPCEH)	-0.024105	0.282341	-0.085371	0.6675
D(LPCER)	0.034261	0.134527	0.254677	0.0022
D(LPCGDP1)	-0.087440	0.322158	-0.271078	0.0042
R-squared	0.973301	Mean dependent var		0.067398
Adjusted R-squared	0.962098	S.D. dependent var		0.118456
S.E. of regression	0.122078	Akaike info criterion		-1.099095
Sum squared resid	0.193740	Schwarz criterion		-0.750588
Log likelihood	17.99095	Hannan-Quinn criter.		-1.031063
F-statistic	68.29468	Durbin-Watson stat		2.383554
Prob(F-statistic)	0.000000			

Source: Eviews 9 output, own calculations

The ECM is no spurious regression model as indicated by the R-squared and DW statistics. The coefficients of LPCEA and LPCEE are positive indicating there is positive relationship between LPCEA and LPCEE with LHDI are significant at 1% level as indicated by t-test. This represents the short run equilibrium coefficient. The coefficient of resid02 is long run equilibrium coefficient which also is known as the error correction coefficient. It is negative and significant as desired.

The primary purpose of this analysis is to find out the equilibrium position of the variables included in the model. As define in equation (10) b_3 and $b_{i,}$ a coefficient of the first difference of the independent variables and one period lag error correction term (U_{t-1}) represent the equilibrium position in the short and long run respectively. The estimated values of these parameters are given in Table 10 above

The Short Run Equilibrium

The estimated value of b_1, b2, b3, b4, b5, are 0.18, 0.05,-0.04., 0.03 and -0.09. These are individually significant at 1% level (Table 10).This coefficients represent the short run coefficients and represent the short run equilibrium. These tell about the rate at which the previous period disequilibrium of the system is being corrected. The value of b_1, b2, b3, b4, b5 is meaning that system corrects its previous period disequilibrium at a speed of 18%,5%,4%, 3%and 9% respectively between the independent variables and dependent variable

The Long Run Equilibrium

U_{t-1} is one period lag error correction term or residual. It guides the variables) of the system to restore back to equilibrium or it corrects disequilibrium. The sign of this should be negative and significant. Parameter b_6 represents its coefficient. It tells about the rate at which it corrects the previous period disequilibrium of the system if it is negative and significant. The coefficient of b_6 is negative (-0.237, Table 11) and is significant at 1% level meaning that system corrects its previous period disequilibrium at a speed of 23.7% annually. It implies that the model identified the sizable speed of adjustment by 23.7% of disequilibrium correction yearly for reaching long run equilibrium steady state position.

A strong relationship exists between electricity of independent variables and the dependent variable in the model over the period of 1992-2013. The regression model is not spurious as tested. The time series data of these variables contain unit root and they become stationary after conducting ADF test. They have long run relation as indicated by Granger casual co-integration test. The statistically significant elasticity coefficient of OLS estimation at level expresses that the 1% change in per capita public expenditure on agriculture, education and road will change the electricity human development index(HDI) by 0.18%.0.05%, and 0.03% respectively these shows that increasing volume of per capita public expenditure on agriculture, education and road has an role to increase electricity HDI and thereby reduce poverty in the country. Thus, the Ethiopian government should formulate policies that can help to mobilize domestic and foreign aid in the productive sector like agriculture, education and road in order to achieve desired

economic growth that can increase electricity human development index and in turn create gainful income to the mass of Ethiopian people to reduce poverty. The results of Error Correction Model indicate that there is both short and long run equilibrium in the system. The coefficient of one period lag residual coefficient is negative and significant which represent the long run equilibrium. The coefficient is -0.237 meaning that system corrects its previous period disequilibrium at a speed of 23.7% annually.

CHAPTER FIVE

5 Summary of Findings, conclusions and Recommendations

5.1 Summary of major Findings

As indicated in Table 10, in terms of goodness of fit, the R-squared and the adjusted R-squared are 0.97 and 0.96 which are consistently higher and thus the static estimates are unbiased as well as the selected explanatory variables explain at least 97% of the variation in human development index. In addition, most explanatory variables enter with the expected sign and have significant effects on poverty reduction. So, the model is a good representation to assess the role of public expenditures on poverty reduction. In addition, the model specification based on the F-statistic, it is also statistically significant.

Based on the results presented in Table 10, the co-integrating regression result of Table 11 shows that the coefficients of agricultural expenditure, education, and road expenditures have the expected signs. However, the coefficient of health and real GDP do not have the expected sign.

The estimates of poverty reduction function via human development index suggest that the per capita expenditure on agriculture, education, road , and per capita GDP are still statistically significant at 1% with the coefficient value of 0.18, 0.05, 0.03 and -0.09 respectively in the short run. Whereas the coefficients of per capita expenditure on health, -0.02 is not statistically significant.

Important finding from this estimation is that human development index tends to be more responsive to the change in the public expenditure on education and agriculture than the change in other public expenditures. The per capita public expenditure on agriculture is the most significant follows by education, and is the largest in magnitude. Therefore, any increase in the government expenditures should focus on the relative importance of agriculture, education and road expenditures compared to health expenditures. The increased public expenditure on education and agriculture as well as rural road should have to be given greater focuses to reduce poverty in the country.This strengthens the validity of the argument calling for focusing public policies on agricultural led

development industrialisation and education (in particular human development strategy) in order to improve the effectiveness of other programmes and thereby reducing poverty. This also confirms the results of Fan et al. (1999, 2002). Hence, the effect of per capita public expenditure on agriculture, education and road has significant in reducing poverty in Ethiopia. Holding others variables constant, for every one percent increases of the per capita expenditure on agriculture, education and road can increase human development index by 0.18%, 0.05%and 0.03% respectively. Ceteris paribus, a rise of one percent per capita expenditure on health and per GDP can also decrease the level of human development index by 0.02 % and 0.09% respectively. Hence, we can say that the government of Ethiopia should allocate more resources to agriculture and education as well as rural road construction in each fiscal year, which guarantee better extension services, research and development, improved technology and inputs as well as quality, equity and access of education and road which result in more production and productivity and educational outcomes for the poorest population. These in turn creates income and capability for the poor people and thereby reduce poverty. This is justified as Ethiopia's agriculture led industrialization, education and road sector development programs emphasize on production and productivity of smallholder farmers, primary, technical and vocational education and training as well as universal rural road access which is costly and the poorest people could get benefit from these subsectors in the short run and long run. This suggests that public expenditure on agriculture, education and road which is targeted towards the basic necessities of the poor might be more effective in reducing poverty in the short run and long run,

On the other hand, the per capita expenditures on health and per capita real GDP have negative sign but health is not statistically significant whereas per capita GDP is statistically significant at 1% which is not consistent with the hypotheses being aimed to test. This may be due to the reason that there might be data problem, i.e. the study does not take in to account the expenditure which is financed from the development partners and donor organization or analysis problem for health expenditure. As we know most of the activities were done by the source of finance from donors and development partners.

The per capita real GDP has also a negative and significant role on poverty reduction. Thus, economic growth per capita reduces the value of human development index. For every 1% raise in per capita real GDP, human development index decreased by 0.09%.This should not come as a surprise that per capita real GDP has a negative effect on human development over the past 22 years. This is justified as first, given that 85% of the population lives rural area and 26% of the people fall below the national poverty line in the rural area as well as everybody in the rural areas derives their livelihood directly from agriculture or agricultural related activities, economic growth per capita since 1992 has been more driven by growth in the service sector. This growth via service sector did not translated in to more poverty reduction (World Bank, 2005 p. 10). Second, service sector growth was largely determined by the expansion of government's share of GDP from about 12% in 1992 to around 45% in 2013.In particular, there was rapid expansion of the service sector during the 1995-2013 period, which can be largely attributed to the military built-up for the border war with Eritrea and financial and distribution services as well as telecom services (Ibid). Therefore, an increase in per capita real GDP largely resulted from service sector expansion through government expenditure mainly on military, financial and telecom. .

5.2 Conclusion

Using country level time series data on public expenditures and poverty indicator such as human development index, this study employ a simple econometric model to estimate the role of public expenditure in education, agriculture, health, and road construction on poverty reduction in Ethiopia during 1992-2013. This paper has sought to generate empirical evidences to help answer the question to what extent the pro-poor public expenditures reduce poverty in Ethiopia on the study period. The main conclusions of this study can be summarised as follows;

- Most of the results reported in this study are consistent in showing that public expenditure on agriculture; health, road construction, and GDP have significant contribution on poverty reduction in Ethiopia. The results concerning the role of

health and GDP on poverty reduction, however, are not consistent with the previous studies.

- Public expenditure on agriculture, education and road public spending help reduce poverty in case of Ethiopia in the study period. Comparatively, among these public expenditures, agricultural expenditure has the largest role on poverty reduction. From this finding, it is possible to conclude that the government of Ethiopia committed to spend more on agriculture and education followed on road construction to reduce poverty in the past 22 years. In order to reduce poverty in the country, the government should allocate more resources for educational and agricultural development, as well as road.

- The per capita expenditures on health and per capita GDP do not have a positive role on poverty reduction. This does not mean that the per capita expenditure on health and per capita GDP do not have an indirect role on poverty reduction. Here, we cannot conclude that these variables do not have the poverty reduction roles, because this study does not take in to account the external finance from aid organization and development partners and the indirect roles of per capita GDP and per capita public expenditures as well as their financing strategies. This is due to the fact that using small sample size, it is difficult to model in detail the dynamic (lagged) effects or long term linkage roles of public expenditures on poverty reduction.

- To the best of my knowledge, this study is the first of its kind in the context of Ethiopia. The main reason for this is that it permits the use of human development index as the dependent variable to assess the role of pro-poor public expenditure on poverty reduction.

- Public expenditure on education, road and agriculture has a positive and strong long run and short run direct role on poverty reduction.

- This study uses short time series aggregated national level data on most poverty oriented expenditures to estimate the role on poverty reduction by controlling the domestic financing strategies. Therefore, further study is needed to make detail analysis and impacts of pro-poor public expenditure on economic growth and poverty reduction using long time series data.

- In order to reduce poverty in the country, the government should allocate more resources for educational and agricultural development, as well as road by cutting defence expenditure and other administrative expenditures.

- The Ethiopian government follows a vital path of poverty reduction activity through human development strategy and agricultural development led industrialisation. Therefore, the Ethiopian government should follow a vital path of poverty reduction activity through human development strategy and agricultural development led industrialisation

5.3 Recommendations

Based on the findings of this study and literatures review, the following points are recommended. It is clear that government expenditure in agriculture and education as well as road has played an important role in reducing poverty in Ethiopia during the past 22 years. Based on literature reviews, public expenditure on agriculture, health, education and roads in rural areas is one of the most important government instruments for reducing mass poverty, therefore cost-effective poverty reduction interventions is required among the poor living in Ethiopia Government expenditures and the design of pro poor growth strategy for poverty reduction should be directed mainly to education, agriculture and roads. This will stimulate activities in the economic sectors and, perhaps, reverse the negative effect of on poverty reduction because it takes into consideration the needs of the poor themselves.

The composition of public expenditure on each sector should have an appropriate economic composition with the right policy mix so as to maximize the positive and strong role of the Pro-poor Public expenditures on poverty reduction. This means that the

government should allocate more resources for primary education and technical and vocational education than the tertiary and administrative activities, because more poor people can gain benefit directly from these subsectors. In addition, allocating more resources for agricultural extension, agricultural inputs and technologies as well as for research and development increases productivity and production and thereby increases income and reduces poverty.

The government should not only allocate more resources for pro-poor sectors in a proper composition but also accompanied by pro-poor agricultural transformation policy, program, and strategies to increase productivity and production as well as to create market for smallholder farmers.

In addition, the public expenditure management should be based on role assessment. In other words, spending money on the provision of public goods and services must take into account the extent to which this expenditure benefits the poor. Therefore, the government of Ethiopia should focus more on the fulfilment and improvement of basic necessities of the poor such as, agriculture, primary health care, primary education, rural infrastructures and food security by allocating more public resources to pro-poor sectors than that of universal and non-basic services and goods.

Based on the appropriate selected research approach identified under this study, short period of time series data were analyzed and discussed. This limits the generalization of the findings of the study in Ethiopia. Therefore, in order to be able to form a general opinion on this, more time series data and detail analysis need to be included in the study to provide adequate data for this purpose. Therefore, this study may be improved by increasing the length of the times series. Hence further investigations are needed to overcome research limitations.

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ANNEX

Annex 1.unit root tests

Null Hypothesis: LHDI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.385298	0.9788
Test critical values:	1% level	-4.616209	
	5% level	-3.710482	
	10% level	-3.297799	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHDI)
Method: Least Squares
Date: 05/20/17 Time: 08:40
Sample (adjusted): 1997 2013
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LHDI(-1)	-0.058440	0.151675	-0.385298	0.7081
D(LHDI(-1))	-0.000377	0.078310	-0.004813	0.9963
D(LHDI(-2))	0.353120	0.063809	5.534033	0.0002
D(LHDI(-3))	-0.026710	0.040438	-0.660514	0.5238
D(LHDI(-4))	-0.141112	0.036371	-3.879813	0.0031
C	-0.033713	0.233856	-0.144162	0.8882
@TREND("1992")	1.16E-05	0.005364	0.002169	0.9983

R-squared	0.972384	Mean dependent var	0.046299
Adjusted R-squared	0.955814	S.D. dependent var	0.052221
S.E. of regression	0.010977	Akaike info criterion	-5.893117
Sum squared resid	0.001205	Schwarz criterion	-5.550029
Log likelihood	57.09149	Hannan-Quinn criter.	-5.859013
F-statistic	58.68441	Durbin-Watson stat	2.207163
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LHDI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.66141	0.0000
Test critical values:	1% level	-4.616209	

	5% level	-3.710482
	10% level	-3.297799

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 17

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHDI,2)
Method: Least Squares
Date: 05/20/17 Time: 08:42
Sample (adjusted): 1997 2013
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LHDI(-1))	-0.788053	0.067578	-11.66141	0.0000
D(LHDI(-1),2)	-0.184598	0.048914	-3.773944	0.0031
D(LHDI(-2),2)	0.190617	0.035702	5.339070	0.0002
D(LHDI(-3),2)	0.151508	0.023426	6.467357	0.0000
C	0.056145	0.016600	3.382170	0.0061
@TREND("1992")	-0.002022	0.000919	-2.199160	0.0502

R-squared	0.995443	Mean dependent var	-0.029855
Adjusted R-squared	0.993372	S.D. dependent var	0.129505
S.E. of regression	0.010544	Akaike info criterion	-5.996028
Sum squared resid	0.001223	Schwarz criterion	-5.701952
Log likelihood	56.96623	Hannan-Quinn criter.	-5.966796
F-statistic	480.5725	Durbin-Watson stat	2.336169
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LHDI,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.138879	0.1311
Test critical values:	1% level	-4.667883	
	5% level	-3.733200	
	10% level	-3.310349	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 16

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHDI,3)
Method: Least Squares
Date: 05/20/17 Time: 08:43
Sample (adjusted): 1998 2013
Included observations: 16 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LHDI(-1),2)	-0.803293	0.255917	-3.138879	0.0105
D(LHDI(-1),3)	-0.195872	0.135479	-1.445778	0.1788

D(LHDI(-2),3)	0.163204	0.063077	2.587386	0.0271
D(LHDI(-3),3)	0.134115	0.030341	4.420303	0.0013
C	-0.005943	0.021994	-0.270209	0.7925
@TREND("1992")	0.000226	0.001356	0.166976	0.8707

R-squared	0.995170	Mean dependent var	0.029330
Adjusted R-squared	0.992755	S.D. dependent var	0.194961
S.E. of regression	0.016595	Akaike info criterion	-5.079451
Sum squared resid	0.002754	Schwarz criterion	-4.789730
Log likelihood	46.63561	Hannan-Quinn criter.	-5.064615
F-statistic	412.0668	Durbin-Watson stat	2.734145
Prob(F-statistic)	0.000000		

Null Hypothesis: LPCEA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.185857	0.4713
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEA)
Method: Least Squares
Date: 05/20/17 Time: 08:44
Sample (adjusted): 1994 2013
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPCEA(-1)	-0.281845	0.128940	-2.185857	0.0440
D(LPCEA(-1))	0.480537	0.187927	2.557037	0.0211
C	0.589418	0.248798	2.369060	0.0308
@TREND("1992")	0.044729	0.020575	2.174019	0.0451

R-squared	0.358326	Mean dependent var	0.153823
Adjusted R-squared	0.238012	S.D. dependent var	0.156326
S.E. of regression	0.136460	Akaike info criterion	-0.968713
Sum squared resid	0.297942	Schwarz criterion	-0.769566
Log likelihood	13.68713	Hannan-Quinn criter.	-0.929837
F-statistic	2.978254	Durbin-Watson stat	1.920247
Prob(F-statistic)	0.062734		

Null Hypothesis: D(LPCEA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.158514	0.1206
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEA,2)
Method: Least Squares
Date: 05/20/17 Time: 08:58
Sample (adjusted): 1994 2013
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCEA(-1))	-0.631391	0.199901	-3.158514	0.0057
C	0.073771	0.087408	0.843980	0.4104
@TREND("1992")	0.001298	0.005904	0.219813	0.8286

R-squared	0.379550	Mean dependent var	-0.022862
Adjusted R-squared	0.306556	S.D. dependent var	0.181166
S.E. of regression	0.150863	Akaike info criterion	-0.807408
Sum squared resid	0.386914	Schwarz criterion	-0.658048
Log likelihood	11.07408	Hannan-Quinn criter.	-0.778251
F-statistic	5.199730	Durbin-Watson stat	1.708877
Prob(F-statistic)	0.017299		

Null Hypothesis: D(LPCEA,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.129462	0.0032
Test critical values:	1% level	-4.532598	
	5% level	-3.673616	
	10% level	-3.277364	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEA,3)
Method: Least Squares
Date: 05/20/17 Time: 08:45
Sample (adjusted): 1995 2013
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCEA(-1),2)	-1.157804	0.225716	-5.129462	0.0001
C	-0.001374	0.098513	-0.013946	0.9890
@TREND("1992")	-0.000561	0.007430	-0.075496	0.9408

R-squared	0.630414	Mean dependent var	0.013745
Adjusted R-squared	0.584216	S.D. dependent var	0.270823
S.E. of regression	0.174630	Akaike info criterion	-0.508351
Sum squared resid	0.487932	Schwarz criterion	-0.359229
Log likelihood	7.829335	Hannan-Quinn criter.	-0.483114
F-statistic	13.64586	Durbin-Watson stat	2.086913

Prob(F-statistic)	0.000348

Null Hypothesis: LPCEE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.175565	0.9890
Test critical values:	1% level	-4.467895	
	5% level	-3.644963	
	10% level	-3.261452	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEE)
Method: Least Squares
Date: 05/20/17 Time: 08:46
Sample (adjusted): 1993 2013
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPCEE(-1)	-0.016323	0.092976	-0.175565	0.8626
C	0.089453	0.218840	0.408760	0.6875
@TREND("1992")	0.011972	0.013842	0.864914	0.3985

R-squared	0.321617	Mean dependent var	0.157456
Adjusted R-squared	0.246241	S.D. dependent var	0.105354
S.E. of regression	0.091468	Akaike info criterion	-1.814097
Sum squared resid	0.150594	Schwarz criterion	-1.664880
Log likelihood	22.04802	Hannan-Quinn criter.	-1.781713
F-statistic	4.266847	Durbin-Watson stat	1.420174
Prob(F-statistic)	0.030428		

Null Hypothesis: D(LPCEE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.088423	0.1354
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEE,2)
Method: Least Squares
Date: 05/20/17 Time: 08:46
Sample (adjusted): 1994 2013
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(LPCEE(-1))	-0.754369	0.244257	-3.088423	0.0067
C	0.030772	0.045466	0.676819	0.5076
@TREND("1992")	0.007790	0.004461	1.746359	0.0988

R-squared	0.360589	Mean dependent var	0.001056
Adjusted R-squared	0.285364	S.D. dependent var	0.106614
S.E. of regression	0.090127	Akaike info criterion	-1.837705
Sum squared resid	0.138090	Schwarz criterion	-1.688345
Log likelihood	21.37705	Hannan-Quinn criter.	-1.808548
F-statistic	4.793488	Durbin-Watson stat	1.845058
Prob(F-statistic)	0.022342		

Null Hypothesis: D(LPCEE,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.110684	0.0054
Test critical values:	1% level	-4.728363	
	5% level	-3.759743	
	10% level	-3.324976	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 15

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEE,3)
Method: Least Squares
Date: 05/20/17 Time: 08:47
Sample (adjusted): 1999 2013
Included observations: 15 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCEE(-1),2)	-6.558096	1.283213	-5.110684	0.0009
D(LPCEE(-1),3)	4.650171	1.116766	4.163961	0.0031
D(LPCEE(-2),3)	3.570023	0.854570	4.177569	0.0031
D(LPCEE(-3),3)	2.588749	0.649514	3.985668	0.0040
D(LPCEE(-4),3)	1.464248	0.488842	2.995337	0.0172
C	-0.132396	0.089504	-1.479228	0.1773
@TREND("1992")	0.014681	0.006888	2.131383	0.0657

R-squared	0.880712	Mean dependent var	-0.008464
Adjusted R-squared	0.791246	S.D. dependent var	0.191447
S.E. of regression	0.087471	Akaike info criterion	-1.730287
Sum squared resid	0.061210	Schwarz criterion	-1.399863
Log likelihood	19.97715	Hannan-Quinn criter.	-1.733806
F-statistic	9.844087	Durbin-Watson stat	1.907334
Prob(F-statistic)	0.002486		

Null Hypothesis: LPCEH has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.417555	0.8250
Test critical values:	1% level	-4.467895	
	5% level	-3.644963	
	10% level	-3.261452	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEH)
Method: Least Squares
Date: 05/20/17 Time: 08:48
Sample (adjusted): 1993 2013
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPCEH(-1)	-0.215765	0.152209	-1.417555	0.1734
C	0.423313	0.199606	2.120742	0.0481
@TREND("1992")	0.034137	0.023669	1.442301	0.1664

R-squared	0.103598	Mean dependent var	0.164925
Adjusted R-squared	0.003998	S.D. dependent var	0.124501
S.E. of regression	0.124252	Akaike info criterion	-1.201454
Sum squared resid	0.277892	Schwarz criterion	-1.052236
Log likelihood	15.61527	Hannan-Quinn criter.	-1.169070
F-statistic	1.040140	Durbin-Watson stat	1.474599
Prob(F-statistic)	0.373701		

Null Hypothesis: D(LPCEH) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.568417	0.0589
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEH,2)
Method: Least Squares
Date: 05/20/17 Time: 08:48
Sample (adjusted): 1994 2013
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCEH(-1))	-0.884522	0.247875	-3.568417	0.0024
C	0.107374	0.072006	1.491175	0.1542
@TREND("1992")	0.002763	0.005116	0.540126	0.5961

R-squared	0.428614	Mean dependent var	-0.013784
Adjusted R-squared	0.361392	S.D. dependent var	0.162120
S.E. of regression	0.129555	Akaike info criterion	-1.111945

Sum squared resid	0.285336	Schwarz criterion	-0.962585
Log likelihood	14.11945	Hannan-Quinn criter.	-1.082788
F-statistic	6.376104	Durbin-Watson stat	1.938951
Prob(F-statistic)	0.008588		

Null Hypothesis: D(LPCEH,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.130520	0.0005
Test critical values:	1% level	-4.532598	
	5% level	-3.673616	
	10% level	-3.277364	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCEH,3)
Method: Least Squares
Date: 05/20/17 Time: 08:49
Sample (adjusted): 1995 2013
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCEH(-1),2)	-1.471674	0.240057	-6.130520	0.0000
C	-0.045159	0.087606	-0.515473	0.6133
@TREND("1992")	0.002227	0.006648	0.335035	0.7420

R-squared	0.702452	Mean dependent var	-0.016970
Adjusted R-squared	0.665258	S.D. dependent var	0.272188
S.E. of regression	0.157480	Akaike info criterion	-0.715102
Sum squared resid	0.396798	Schwarz criterion	-0.565980
Log likelihood	9.793465	Hannan-Quinn criter.	-0.689864
F-statistic	18.88638	Durbin-Watson stat	1.853239
Prob(F-statistic)	0.000061		

Null Hypothesis: LPCER has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.684541	0.0008
Test critical values:	1% level	-4.467895	
	5% level	-3.644963	
	10% level	-3.261452	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCER)

Method: Least Squares
Date: 05/20/17 Time: 08:49
Sample (adjusted): 1993 2013
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPCER(-1)	-0.426529	0.075033	-5.684541	0.0000
C	1.112279	0.130225	8.541205	0.0000
@TREND("1992")	0.042664	0.012900	3.307226	0.0039

R-squared	0.753170	Mean dependent var	0.200223
Adjusted R-squared	0.725745	S.D. dependent var	0.273486
S.E. of regression	0.143223	Akaike info criterion	-0.917263
Sum squared resid	0.369231	Schwarz criterion	-0.768046
Log likelihood	12.63126	Hannan-Quinn criter.	-0.884879
F-statistic	27.46235	Durbin-Watson stat	1.537618
Prob(F-statistic)	0.000003		

Null Hypothesis: D(LPCER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.346530	0.3930
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCER,2)
Method: Least Squares
Date: 05/20/17 Time: 08:49
Sample (adjusted): 1994 2013
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCER(-1))	-0.425457	0.181313	-2.346530	0.0313
C	0.093008	0.130178	0.714463	0.4846
@TREND("1992")	-0.003442	0.008582	-0.401054	0.6934

R-squared	0.287197	Mean dependent var	-0.033378
Adjusted R-squared	0.203338	S.D. dependent var	0.202856
S.E. of regression	0.181061	Akaike info criterion	-0.442486
Sum squared resid	0.557312	Schwarz criterion	-0.293126
Log likelihood	7.424857	Hannan-Quinn criter.	-0.413329
F-statistic	3.424749	Durbin-Watson stat	1.804770
Prob(F-statistic)	0.056266		

Null Hypothesis: D(LPCER,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-5.452686	0.0017
Test critical values:	1% level	-4.532598	
	5% level	-3.673616	
	10% level	-3.277364	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCER,3)
Method: Least Squares
Date: 05/20/17 Time: 08:50
Sample (adjusted): 1995 2013
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCER(-1),2)	-1.163194	0.213325	-5.452686	0.0001
C	-0.251003	0.105468	-2.379894	0.0301
@TREND("1992")	0.016299	0.007889	2.066160	0.0554

R-squared	0.655116	Mean dependent var	-0.013657
Adjusted R-squared	0.612005	S.D. dependent var	0.293963
S.E. of regression	0.183107	Akaike info criterion	-0.413552
Sum squared resid	0.536451	Schwarz criterion	-0.264430
Log likelihood	6.928743	Hannan-Quinn criter.	-0.388315
F-statistic	15.19619	Durbin-Watson stat	1.271776
Prob(F-statistic)	0.000200		

Null Hypothesis: LPCGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.472279	0.9982
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCGDP)
Method: Least Squares
Date: 05/20/17 Time: 08:51
Sample (adjusted): 1994 2013
Included observations: 20 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPCGDP(-1)	0.038515	0.081551	0.472279	0.6431
D(LPCGDP(-1))	-0.270782	0.258976	-1.045589	0.3113
C	-0.254804	0.494795	-0.514968	0.6136
@TREND("1992")	0.011688	0.008759	1.334368	0.2008

R-squared	0.591876	Mean dependent var	0.129152
Adjusted R-squared	0.515353	S.D. dependent var	0.103107
S.E. of regression	0.071780	Akaike info criterion	-2.253567
Sum squared resid	0.082438	Schwarz criterion	-2.054421
Log likelihood	26.53567	Hannan-Quinn criter.	-2.214692
F-statistic	7.734594	Durbin-Watson stat	2.031320
Prob(F-statistic)	0.002050		

Null Hypothesis: D(LPCGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.366484	0.0860
Test critical values:	1% level	-4.532598	
	5% level	-3.673616	
	10% level	-3.277364	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCGDP,2)
Method: Least Squares
Date: 05/20/17 Time: 08:51
Sample (adjusted): 1995 2013
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCGDP(-1))	-1.193018	0.354381	-3.366484	0.0042
D(LPCGDP(-1),2)	-0.195890	0.218280	-0.897427	0.3837
C	-0.048695	0.040756	-1.194814	0.2507
@TREND("1992")	0.017461	0.005505	3.171900	0.0063

R-squared	0.667888	Mean dependent var	0.005523
Adjusted R-squared	0.601465	S.D. dependent var	0.109768
S.E. of regression	0.069296	Akaike info criterion	-2.316191
Sum squared resid	0.072029	Schwarz criterion	-2.117361
Log likelihood	26.00381	Hannan-Quinn criter.	-2.282541
F-statistic	10.05515	Durbin-Watson stat	2.231965
Prob(F-statistic)	0.000700		

Null Hypothesis: D(LPCGDP,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.102773	0.0006
Test critical values:	1% level	-4.571559	
	5% level	-3.690814	
	10% level	-3.286909	

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

Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 18

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPCGDP,3)
Method: Least Squares
Date: 05/20/17 Time: 08:52
Sample (adjusted): 1996 2013
Included observations: 18 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPCGDP(-1),2)	-2.941103	0.481929	-6.102773	0.0000
D(LPCGDP(-1),3)	0.685109	0.250952	2.730037	0.0163
C	-0.048371	0.049792	-0.971466	0.3478
@TREND("1992")	0.005960	0.003876	1.537748	0.1464

R-squared	0.865613	Mean dependent var	-0.017243
Adjusted R-squared	0.836816	S.D. dependent var	0.188628
S.E. of regression	0.076198	Akaike info criterion	-2.117824
Sum squared resid	0.081287	Schwarz criterion	-1.919964
Log likelihood	23.06042	Hannan-Quinn criter.	-2.090542
F-statistic	30.05887	Durbin-Watson stat	1.831920
Prob(F-statistic)	0.000002		