



Empirical Analysis of the Relationship between Poverty and Economic Growth in Ethiopia: Micro- Panel Data Evidence from Amhara Region

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Authors' contributions

This work was carried out in collaboration between both authors. Author KK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author GN managed the literature searches, assisted in methodology, supervised the work and edited the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Reduction of poverty is still a vital concern and main challenge for Ethiopia, the second most populous country after Nigeria, in the SSA. With the government's consistent implementation of its Poverty-Reduction-Strategy (PRS) Ethiopian households experienced a decade of remarkable progress in wellbeing. Poverty in Ethiopia declined at an annual average of 2.32 percentage points since 1995. Besides, Ethiopia, having registered high economic growth since 2005 at an average of 10.8 percent per annum, stands out as one of the fastest growing economies in the world. Despite all this, Ethiopia is amongst the poorest countries in the world, with a very low human-development ranking, or 174th out of 188 countries according to the UNDP's human development report 2015. According to the estimation of the WB, About 23 million of Ethiopians live in condition substantially below the basic poverty line and food security remains a major challenge. This study examines the empirical relationship between growth and poverty in Amhara National Regional State (ANRS) of Ethiopia. The study estimated the fixed effects models (FEM) using panel data from four household income, consumption and expenditure (HICE) surveys conducted in the region between the period 1995/96 to 2010/11 by the central statistics authority (CSA) of Ethiopia.

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The FEM estimation results of this study indicated that growth in average expenditure per capita of a household and change in inequality has a negative and significant and positive insignificant effect on poverty in the ANRS, respectively, implying that growth plays a pivotal role on reducing poverty and a rise in inequality lead to a rise in poverty in ANRS. The study has also revealed that growth contributes far more towards reducing poverty, keeping inequality constant, than the latter does to increasing poverty, holding the former constant. Besides, estimation of the net effects of growth on poverty indicated that the absolute magnitude of the net elasticity of poverty to growth is smaller than that of the gross elasticity of poverty to growth, implying that some of the growth effect on poverty is offset by the increase in inequality. Based on the finding of this study, we recommend that, at a policy level, in order to deal with poverty problems effectively, the government should implement policies focusing on growth as well as redistributing income in favour of the poor and middle class households in all administrative zones of the region.

Keywords: Poverty; growth; fixed effects model; panel data.

ABBREVIATIONS

<i>ANRS</i>	: <i>Amhara National Regional State</i>
<i>CBM</i>	: <i>Cost of Basic Needs Method</i>
<i>CSA</i>	: <i>Central Statistics Authority, Ethiopia</i>
<i>FEM</i>	: <i>The Fixed Effects Model</i>
<i>GDP</i>	: <i>Gross Domestic Product</i>
<i>HCE</i>	: <i>Household Consumption and Expenditure Survey</i>
<i>HICE</i>	: <i>Household Income, Consumption and Expenditure Survey</i>
<i>MDG</i>	: <i>Millennium Development Goal</i>
<i>PSNP</i>	: <i>Productive Safety Net Programme</i>
<i>RGDP</i>	: <i>Real Gross Domestic Product</i>
<i>SSA</i>	: <i>Sub-Saharan Africa</i>
<i>UNDP</i>	: <i>United Nations Development Programme</i>
<i>WB</i>	: <i>World Bank</i>

being attributed most of the global poverty reduction and, most notably, the Sub-Saharan African countries lagging behind with a modest drop from 56 percent to 48 percent between 1990 and 2010. Although the point estimates of poverty shows that incidence of poverty has fallen in the region over the period 1990-2010, at the same time, however, the population continued to expand rapidly which led the region to experience a steady increase in the number of population living in extreme poverty, rising from 285 million to about 419 million [2]. Out of the 27 countries that in 2010 are estimated to have extreme poverty rates at 40% or above, 26 are situated in SSA. This disappointing low level of poverty reduction in SSA has occurred despite of relatively strong income growth. SSA had an unweighted average GDP growth of more than 5 percent between 1995 and 2010.

1. INTRODUCTION

1.1 Background of the Study

Halving extreme poverty and hunger is the first and probably the most important goal over which all member countries of the UN have agreed to achieve between the periods 1990-2010. Remarkable success has been recorded, given that it was uneven among countries and regions, at the global level with respect to meeting the target of halving global extreme poverty rates. According to the estimates of the World Bank, extreme poverty has been halved in developing regions already five years ahead of schedule with the proportion of people living below 1.25 US dollar a day having been reduced from 44 percent in 1990 to 22 percent in 2010 [1].

However, the progress has been uneven among countries and regions, with China and India

Ethiopia, the second most populous country in Africa after Nigeria, like many other SSA countries, is characterized by very high poverty. With a per capita gross national income (GNI) of USD 590 in 2015, the country is classified as a low income country. According to the estimates of the WB, approximately about 29.6 percent of the population were living on less than USD 1.25/day in 2011 [3].

Given the level of poverty in Ethiopia and the importance of growth on poverty alleviation, the relationship between growth and poverty deserves more attention. Therefore, with the aim of examining the relationship between growth and poverty in Ethiopia and adding to the literature on poverty by examining the relationship in the country, the study has been carried out by using four round panel of HICE surveys collected by the CSA of Ethiopia and employed the FEM of panel data analysis.

1.2 Objective of the Study

The general objective of this study is to examine the empirical relationship between poverty and economic growth in Ethiopia by taking four round HICE panel data surveys from ANRS. The specific objectives are to:

- i) Examine the combined effect of economic growth and change in inequality on poverty reduction,
- ii) Examine the net effect of growth on poverty, and
- iii) Make recommendation relying on the findings.

The paper is organized as follows: the second section provides an overview of poverty and economic growth trend in Ethiopia, while the third section reviews the literature. The fourth section discusses the estimation techniques used in the analysis, as well as the regression result. Lastly, the fifth section concludes the study and makes policy recommendations.

2. TRENDS OF POVERTY AND ECONOMIC GROWTH IN ETHIOPIA

2.1 Trend of Poverty in Ethiopia

Reduction of poverty is still a vital concern and main challenge for Ethiopia, the second most populous country after Nigeria, with above 90 million inhabitants [4], in the SSA. With the government's consistent implementation of its Poverty-Reduction-Strategy (PRS) pro-poor spending continues to rise 73 percent of total expenditure in 2014/15. As a result, Ethiopian households experienced a decade of remarkable progress in wellbeing. Poverty in Ethiopia declined at an annual average of 2.32 percentage points since 1995. According to the latest available national statistics on poverty, based on head count rate (cost of basic needs method, CBM), the proportion of people living below the national poverty line fell from a baseline of 48.8 percent in 1990 to 45.5 percent in 1996 and 29.6 percent at national level, 30.4 percent in rural and 25.7 percent in urban areas, in 2011, and is estimated to have further declined to 23.4 percent in 2015, which is below the MDG target of 24 percent [5].

Despite all this, Ethiopia is amongst the poorest countries in the world, with a very low human-development ranking, or 174th out of 188

countries according to the UNDP's human development report 2015. About 23 million of Ethiopians live in condition substantially below the basic poverty line and food security remains a major challenge. Poverty is mainly a rural phenomenon, as the share of the population below the poverty line in rural areas stood at 30.4 percent, while it was 25.7 percent in urban areas.

The reduction in poverty was driven mainly by agricultural growth, underpinned by high and consistent economic growth. Moreover, the decline in poverty is attributable to the recent implementation of welfare programmes such as the Productive Safety Net Program (PSNP), as well as urban food distribution and subsidies. The PSNP reaches close to seven million chronically food-insecure individuals and has a strong focus on addressing the poverty of female headed households and encouraging women's participation in public-works activities [6]. However, progress in poverty reduction is not without its challenges and poverty remains widespread in Ethiopia. The poorest households have become poorer than they were in 2005; high food price that improves incomes for many farmers make buying food more challenging for the poorest. Despite improvements, Ethiopia still has relatively low rates of education enrollement, access to sanitation, and attended births, and challenges remain around investment in the health and education of women [7].

Spatially disaggregated analyses also indicate marked disparities amongst regions, largely attributed to differences in stages of development and to resource endowments. In 2010/11, the poverty headcount index was highest in Afar region (36.1%) followed by Ethiopian Somali (32.8 percent) and Tigray (31.8 percent) regions, while the poverty estimates were lowest in the Harari region (11 percent) followed by the cities of Dire Dawa (28.3 percent) and Addis Ababa (28.1 percent). For poverty to decline significantly, there has to be a concerted effort and perhaps a new approach to address the structural problem of the agricultural sector.

2.2 Trend of Economic Growth in Ethiopia

Ethiopia, having registered high economic growth since 2005 at an average of 10.8 percent per annum, stands out as one of the fastest growing economies in the world. In 2014/15, real GDP grew by 10.2 percent, keeping the momentum of

10.3 percent growth rate of 2013/14. The country's strong economic performance has mainly been underpinned by public sector led development [8]. The real gross domestic product (GDP) growth continued to be broad

based, with all sectors contributing. The agriculture, service and industry sectors accounted for 38.8 percent, 46.6 percent and 15.2 percent of the real GDP in 2014/15, respectively.

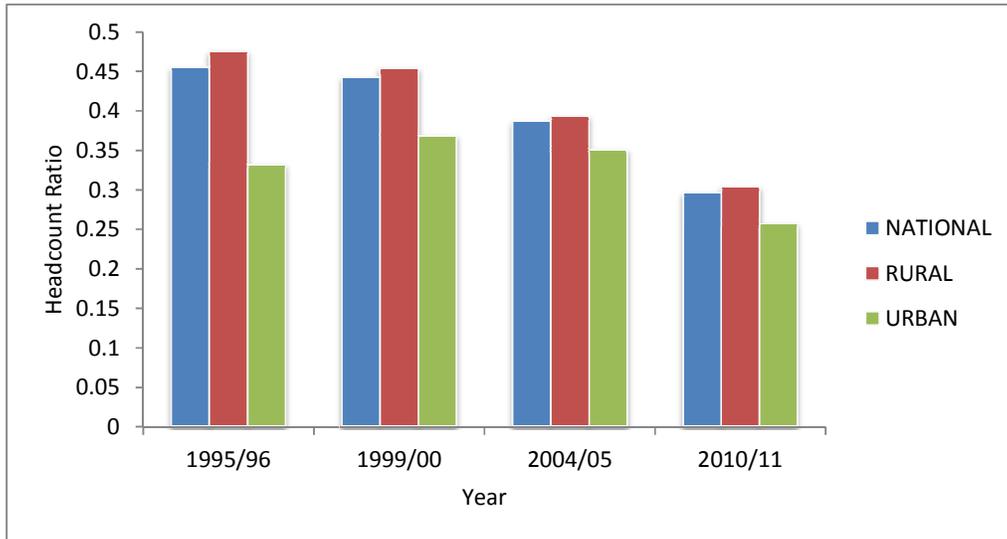


Fig. 1. Trends of Poverty Headcount Indices by National, Rural and Urban

Source: HICE survey of 1995/96, 1999/00, 2004/05 and 2010/11

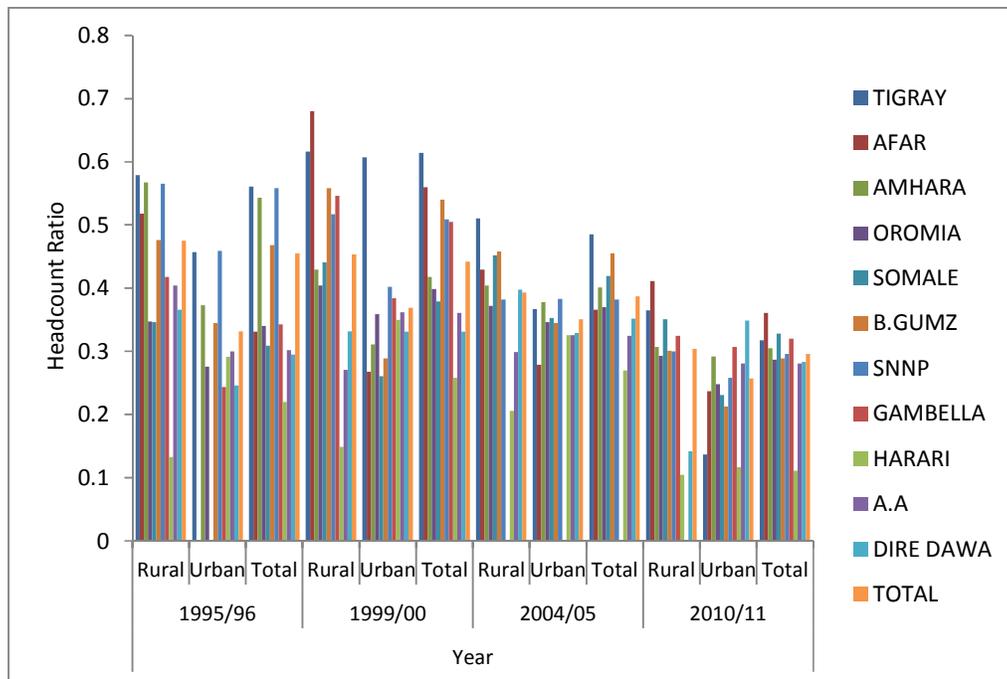


Fig. 2. Trends of regional poverty headcount indices

Source: CSA, HICE Survey of 1995/96, 1999/00, 2004/05 and 2010/11

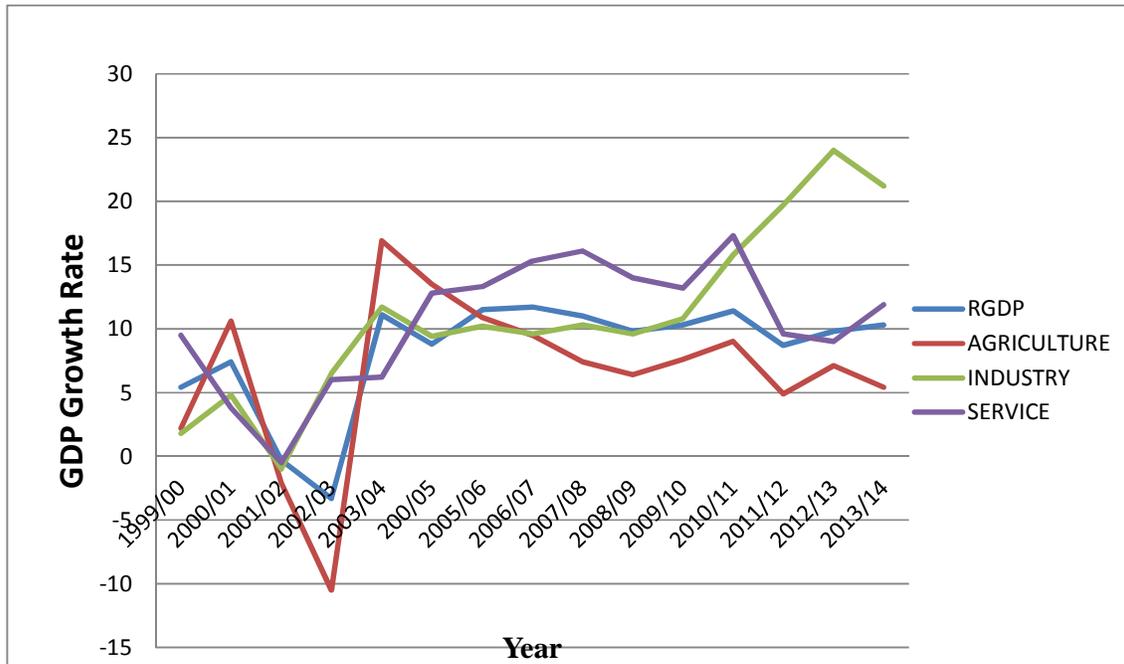


Fig. 3. Sectoral and Real GDP Growth Trends

Source: Own Computation of data from NBE

The service sector has been gaining much importance in GDP. Its share has increased from 39.3 percent in 2006/07 to 45.9 percent in 2014/15, mainly due to improvements in hotels and tourism (29.2 percent), transport and communications (13.3 percent), wholesale and retail trade (9.9 percent) and financial intermediation (6.9 percent). According to an employment-unemployment survey by the central statistical agency of Ethiopia, about half of people employed in urban areas are absorbed by service sectors. In addition, the informal sector, which is mainly concerned with services, makes up 31.7 percent of urban employment [9].

The service sector contributed 4.7 percentage points of this growth followed by industry and agriculture contributing 3 and 2.5 percentage points, respectively. While the share of agriculture in the GDP declined over ten years from 47 percent in 2004/05 to 39 percent in 2014/15 that of the service sector increased from 40 percent to 46 percent in the same period. The strong economic growth has been underpinned by the country's public sector – led development strategy, with its focus on heavy investment in infrastructure.

Despite its declining contribution to GDP over the years, agriculture still remains the leading sector

in terms of contribution to the country's overall economy. Agriculture continues to be the backbone of the Ethiopian economy, contributing 39.9 percent to GDP, about 73 percent of employment and 70 percent of export earnings in 2014/15. Moreover, the sector supplies 70 percent of raw materials requirements of local industries and it is the major source of food for domestic consumption of raw materials for domestic manufacturing industries and of primary commodities export. Ethiopia's agriculture depends heavily on traditional farming methods and rain-fed farming system, and is vulnerable to environmental and climate related shocks.

Despite the remarkable economic growth registered in the last decade, Ethiopia is still one of the poorest countries in the world [10].

3. LITERATURE REVIEW

Views on the relationship between economic growth and poverty are generally put into two theories, which are the 'trickle-down theory' and the 'trickle-up theory'. Proponents of the "trickle-down theory" assert that economic growth plays an essential role in poverty reduction in any given country, given that the distribution of income remains constant. They believe that the benefits of higher economic growth in a country

trickle down to the poor. Alternatively, the "trickle down hypothesis" suggests that a time lag exists before the poor benefit from economic growth. For example, economic growth may initially generate greater profits for existing firm owners and current employees. Their higher incomes may generate greater demand for products which will result in firm expansion. Firm growth may generate demand for additional employees including the unskilled poor, who may then reap the benefits of economic growth.

On the other hand, proponents of the 'trickle-up theory' assert that economic growth does not improve the lives of the very poor; but rather, the 'growth process' tend to 'trickle-up' to the middle classes and the very rich [11]. This, in turn, results in a worsening of the distribution of income (i.e., increase in inequality) which then increases poverty. Put differently, the theory asserts that there are reinforcing factors that maintain poverty amongst the poor population and impede them from contributing to economic growth.

The literature essentially contends that countries do not grow fast, because they are simply too poor to grow. This is because poverty dampens economic growth by creating a vicious circle of whereby high poverty leads to lower aggregate growth. In turn, low growth results in high levels of poverty. In such a scenario, development policies should be aimed at improving the living standards of the poor, which in turn, would ultimately result in virtuous circles that promote economic growth.

Many studies have been conducted on the relationship between poverty and economic growth to verify the theoretical postulation relating to poverty and growth nexus in both developed and under developing countries. Some of these studies empirically concluded that economic growth has negative significant impact on poverty, while others asserted otherwise. While the literature on this topic is plentiful, here we present a brief review of studies that are most relevant for our analysis. For instance, De Janvry and Sadoulet [12] carried out a study to examine the determinants of change in poverty and inequality in twelve Latin American Countries for the period 1970-1994. They found out a negative and significant relationship between poverty and income growth which implies that per capita aggregate income growth leads to a reduction in the incidence of urban and rural poverty. Similarly, Easterly [13] states that countries with

positive income growth had a decline in the proportion of people below the poverty line, and the fastest average growth was associated with the fastest poverty reductions. In Indonesia, for example, which had average income growth of 76 percent from 1984 to 1996, the proportion of Indonesians beneath the poverty line in 1993 was one-quarter of what it was in 1984. Moreover, Bigsten et al. [14] examined the impact of growth on poverty in Ethiopia using panel data from 1994-1997, which they consider it a period of economic recovery driven by peace, good weather and much improved macroeconomic management. Empirical evidence from their study showed that economic growth has a negative and significant relationship with poverty. This implies that economic growth is key to poverty reduction in Ethiopia. Their result on the decomposition of changes in poverty into growth and redistribution components also indicates that potential poverty reduction due to the increase in real per capita income was to some extent counteracted by worsening income distribution.

Adams [15] used data collected in 126 countries including 60 developing countries to analyse the elasticity of poverty. He found that economic growth reduces the proportion of poverty; however, the measurement of the relationship between growth and poverty based on cross-country data is often questionable. Tasai and Huang [16], using time series data from 1964 to 2003, analysed the relationship between growth and poverty in Taiwan. They confirmed that economic growth is a major driving force for poverty reduction in Taiwan. Similarly, Basu and Mallick [17] have also examined the relationship between poverty and economic growth in India using several measures. They found modest evidence to suggest that economic growth led to a reduction in poverty. In addition, findings from the study conducted by Agarwal [18] to examine the relation between economic growth and poverty alleviation in the case of Kazakhstan, using province-level data and using Additively Decomposable Poverty Measures, showed that provinces with higher growth rates achieved faster decline in poverty.

A study conducted, by employing the ARDL-Bounds testing approach, to investigate the causal relationship between financial development, economic growth and poverty in South Africa for the period 1960-2006 by Odhiambo [19] showed that a unidirectional causal flow from economic growth to poverty

reduction existed in South Africa. Similarly, Gelaw [20] empirically examines the relationship between poverty, inequality and growth in rural Ethiopia using a panel data of Ethiopian Rural Household Survey (ERHS) for the period 1994-2004. The author adopted the fixed effects regression model for estimation. Results of the study show that poverty gap and growth in real per capita consumption has a negative and significant relationship which implies growth in mean consumption reduces poverty gap in rural Ethiopia.

Young [21] uses estimates of the level and growth of real consumption to investigate changes in poverty in 29 sub-Saharan and 27 other developing countries. The author found that living standards in Sub-Saharan African countries have improved during the last two decades—there by implying a reduction in poverty. Ijaiya et al. [22] examined the impact of economic growth on poverty reduction in Nigeria by taking into consideration a time subscript and a difference-in-difference estimator that describes poverty reduction as a function of changes in economic growth. Using a multiple regression analysis, the result obtained indicates that the initial level of economic growth is not prone to poverty reduction, while a positive change in economic growth is prone to poverty reduction. The study suggest that to improve and sustain the rate of economic growth in Nigeria from which poverty could be reduced measures, such as, stable macroeconomic policies, huge investment in agriculture, infrastructural development and good governance are to implemented. In a similar case, Mulock et al. [23] determined the empirical relationship and importance of growth for poverty reduction in Malaysia. The results showed that growth explains much, but not all, about the evolution of poverty. They stated that economic growth is necessary but not sufficient for poverty reduction, especially if the objective is a rapid and sustained poverty reduction. If a policy objective is focused on poverty alleviation, it is necessary to consider additional variables such as income distribution.

Furthermore, Nurudden and Ibrahim [24] examined the relationship between poverty, inequality and economic growth in Nigeria using a secondary time series data from 2000-2012. Employing bound testing to cointegration and granger causality techniques, result of the study show that there is a unidirectional causal relationship running from RGDP to poverty, which means that an increase in GDP in Nigeria

causes high level of poverty. Similarly, Kalawole et al. [25] empirically investigated the relationship among poverty, inequality and economic growth in Nigeria using a time series data over the period from 1980 to 2012. By employing the Ordinary Least Squares (OLS) regression equations, result of the study reveal that growth has a negative significant effect on poverty which implies growth has crucial role in reducing poverty in the country.

As expected some of these studies provide empirical evidence to support the negative and significant relationship between poverty and economic growth while others provide otherwise. Unlike to the above mentioned findings, an empirical study conducted in Nigeria by Aigbokhan [26] to investigate the relationship between poverty, inequality and economic growth for the period 1986 to 1996 revealed a positive and significant relationship between growth and poverty which implies that the remarkable growth of the Nigerian economy from 1986 to 1992 exacerbated the level of poverty in the country. His findings suggest that the so-called “trickle down” phenomenon, underlying the view that growth reduces poverty and inequality, is not supported by Nigeria’s data. In a similar case for Nigeria, Stephen and Simeon [27] conducted a research on economic growth and poverty in Nigeria and the results revealed that there is positive and significant relationship between economic growth and poverty which implies that economic growth does not reduce poverty.

From the literature review above, it could be seen as plenty of studies have been conducted in on relationship between poverty and economic growth. Using different methods such as OLS, ARDL-Bounds testing approach, etc. The results from these previous studies are mixed. But majority of these results support a negative and significant relationship between poverty and economic growth. In addition, the number of studies in Ethiopia which tries to figure out the relationship between poverty reduction and economic growth are few. In view of this problem in mind, it is the intent of this paper to fill in the identified gap.

4. DATA AND METHODOLOGY

4.1 Data

The study made use of panel data from the Household Income, Consumption and

Expenditure (HICE) surveys of year 1995, 2000 and 2005 and Household Consumption and Expenditure (HCE) survey of the year 2010 collected by the CSA of Ethiopia. The HICE survey is representative at national, regional and administrative zone level covering a total of about 2982, 3338, 3656, and 3038 households for the survey year of 1995, 2000, 2005 and 2010, respectively. Mean per capita household expenditure is used as a welfare measure to proxy incidence of poverty and growth in Amhara National Regional State (ANRS) of Ethiopia.

Panel data (also known as longitudinal or cross-sectional time series data) is a dataset in which the behaviour of entities is observed across time. Studies on cross sectional and time series data have faced certain problems and limitations. To avoid such limitations of each cross section and time series data, the present study utilizes panel data to analyze the trends of different cross section over time. Hsiao (2003) and Klevmarcken (1989), as cited in Badi Baltagi [28], list several benefits of using panel data which include the following: (a) they provide more efficient estimations of parameters by considering broader sources of variations, (b) they outsource more information to the analyst, and (c) they allow the study of the dynamics behaviour of the parameters (d) Pooling increases the number of observations. (e) Panel data permits controlling for some types of unit heterogeneity. (f) Panel data allows testing theories that make forecasts in space and time. (g) Panel data allows to explicitly modelling dynamics.

4.2 Methodology

4.2.1 Measuring poverty and inequality

To answer the research question whether there is a relationship between changes in growth and level of poverty in the Amhara National Regional State (ANRS), it was necessary to determine the changes in the level of poverty and the change in inequality. The FGT class of measure followed by inequality measure was calculated. The inequality measure involves the Gini coefficient and for the poverty measures the PH was calculated.

The study used household expenditure on food and consumables to measure growth, poverty and inequality. Expenditure/consumption was preferred for the reason that expenditure/consumption data are more reliable and simple to compute than income (Deaton [29];

Dercon [30]; Duclos & Araar [31] and CSA [32]). Deaton explained that income is often a more sensitive topic than is consumption, especially since the latter is more obvious to friends and neighbours than the former. Moreover, estimating income requires knowledge on assets and profits – the estimation of both is a very difficult task. Thus, consumption/expenditure was taken as a proxy variable for income or to measure inequality.

4.2.1.1 Measuring poverty

The FGT class of measures (P_α) from Foster-Greer-Thorbecke [33] was used to contextualize poverty in ANRS. These measures range from 0 to 100%. The following equation defines the FGT poverty measures. Where α is the nonnegative parameter, z denotes the poverty line, y is the household consumption expenditure and n is the population. The poverty headcount index (PH) for $\alpha=0$, the poverty gap index (PG) for $\alpha=1$ and squared poverty index (SPG) for $\alpha=2$.

$$P_\alpha = \frac{1}{n} \sum_{y \leq z} \left[1 - \frac{y}{z}\right]^\alpha \quad (\alpha \geq 0)$$

The poverty headcount index (incidence of poverty) is calculated by dividing the number of people whose consumption per capita is below the poverty line, according to the definition of the poverty line in the region. This index may also be expressed mathematically as $P_0 = q/n$, where q is the number of poor people in this region and n is the total population of the region. The higher the number of this index the higher is the population living under the poverty line and experience bad conditions.

4.2.1.2 Measuring inequality

The Gini coefficient, a measure that has been very widely used and older representations of inequality, attributed, as cited in Foster and Sen [34], to Gini (1912) and much analysed by Ricci (1916) and later by Dalton (1920), Yntema (1938), Atkinson (1970a), Newbery (1970), Sheshinski (1972), and others, was used in this study to measure expenditure inequality at household level in ANRS. One way of viewing it is in terms of the Lorenz curve, due to Lorenz [35], which plots the percentage share of the population arranged from the poorest to the richest on the horizontal axis against the percentage share of income received by the bottom $x\%$ of the population is shown on the vertical axis.

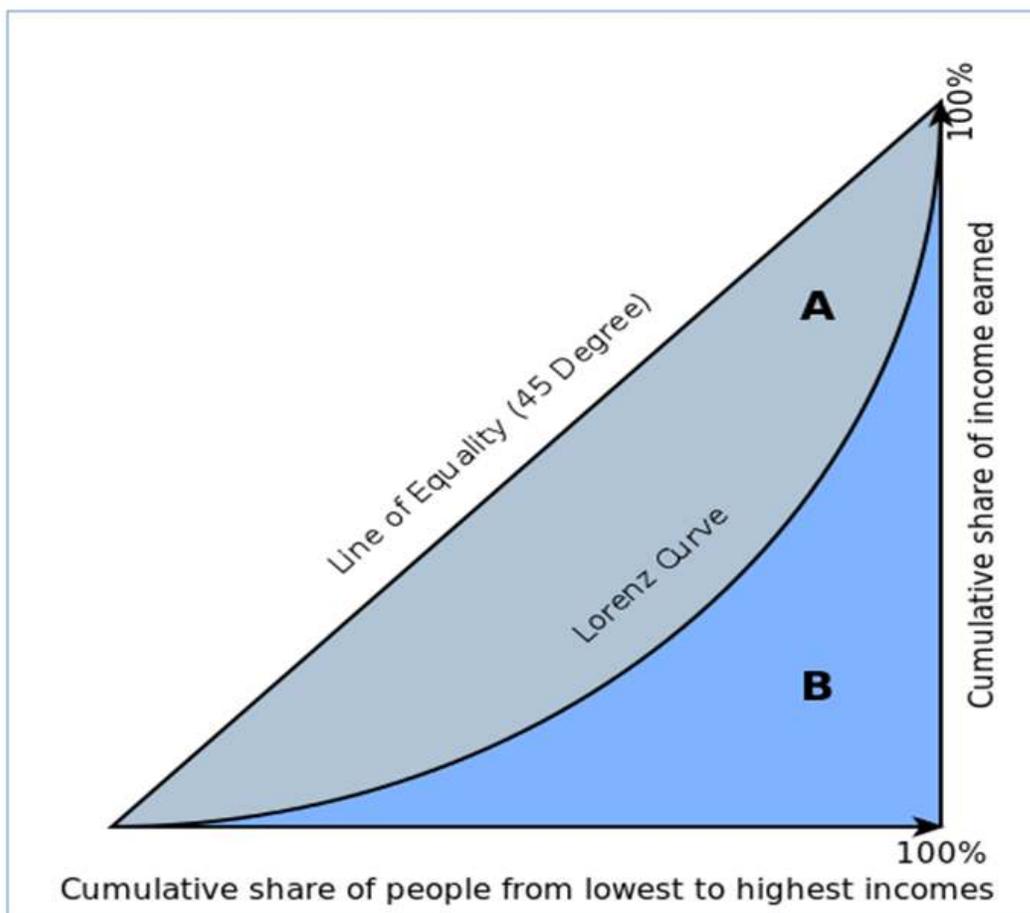


Fig. 4. Graphical Representation of the Gini coefficient

Source: Wikipedia, the free Encyclopedia http://en.wikipedia.org/wiki/Gini_coefficient

Obviously 0% of the population enjoys 0% of the income and 100% of the population enjoy all the income. So a Lorenz curve runs from one corner of the unit square to the diametrically opposite corner. If everyone has the same income the Lorenz curve will be simply the diagonal, but in the absence of perfect equality the bottom income groups will enjoy a proportionately lower share of income. It is obvious, therefore, that any Lorenz curve must lie below the diagonal (except the one of complete equality which would be the diagonal), and its slope will increasingly rise, at any rate not fall, as we move to richer and richer sections of the population.

The lower the value of the Gini coefficient, the more equal the distribution of income; the higher the value of the Gini coefficient, the more unequal the distribution of income. A 0 value indicates perfect equality (every person has

equal income) and a value of 1 shows perfect inequality (one person has all the income) [36].

Formally, let x_i be a point on the X-axis, and y_i a point on the Y-axis. Then

$$Gini = 1 - \sum_{i=1}^N (x_i - x_{i-1})(y_i + y_{i-1})$$

When there are N equal intervals on the X-axis, the above equation simplifies to

$$Gini = 1 - \frac{1}{N} \sum_{i=1}^N (y_i + y_{i-1})$$

4.2.2 The fixed effects model (FEM)

FE model of panel data analysis was used to explore the relationship between explained and

explanatory variables within an entity. FEM assumes that some factors within the entity may have impact on explained variables. FEM controls these factors by introducing dummy variables for time invariant characteristics *i.e.*, religion and race *etc.* Time invariant features are unique and exclusive for each cross section. It is not correlated with other individual characteristics. So, each entity is different, therefore, error and intercept terms of each entity is not correlated with others. FEM has constant slopes and different intercept term for each cross section unit. It can also be said that Fixed Effects Estimator treated the entity specific or group specific. This means that it allows the different constant for each entity. The functional form of FEM is presented as follow:

$$Y_{it} = (\alpha + u_i) + X'_{it}\beta + v_{it}$$

Where: Y is the dependant variable; α represents intercept for each cross section unit; X is an explanatory variable; i stands for each cross section entity or unit; and t is time period and u represents an error term or disturbance term.

To empirically examine the relationship between economic growth, measured by the average per capita expenditure of a household, poverty, measured by incidence of poverty, and inequality, measured by Gini coefficient of mean per capita expenditure, the Fixed Effects Model (FEM) was applied, following Cheema and Sail [37], to estimate the following equation:

$$\ln POV_{it} = \alpha_0 + \alpha_1 \ln(APE_{it}) + \alpha_2 \ln(GC_{it}) + u_i + \varphi_t + \varepsilon_{it} \quad (1)$$

$$H_0: \alpha_1 = \alpha_2 = 0$$

$$H_1: \alpha_1 < 0 \text{ and } \alpha_2 > 0$$

Where: $i = 1, \dots, N$ refers to the cross-section of the administrative zones; $t = 1, \dots, T$ refers to the number of years; POV_{it} denotes to the poverty incidence, measured by the poverty headcount ration, of administrative zone i in year t ; APE_{it} denotes to the average per capita household expenditure of administrative zone i in year t ; GC_{it} i in year t ; u_i represents area fixed or random effects; φ_t is a time specific factor and ε_{it} is an error term such that $\varepsilon_{it} \sim IID(0, \delta^2 \text{ for all } i \text{ and } t)$.

Furthermore, the net growth elasticity of poverty was estimated given that inequality changes during the growth process. According to the literature on the relationship between poverty and growth, a rise in inequality will affect poverty

adversely since inequality is assumed to negatively affect the poverty reducing role of economic growth. However, if inequality declines, it will reinforce the growth impact on poverty and resultantly, poverty will decline more than if inequality were to remain unchanged. Hence, it is important that we estimate the net growth impact of growth on poverty while allowing inequality to change. The following equation was specified to empirically estimate the net growth elasticity of poverty in ANRS of Ethiopia.

$$\ln POV_{it} = \alpha_0 + \alpha_1 \ln(APE_{it}) + u_i + \varphi_t + \varepsilon_{it} \quad (2)$$

$$H_0: \alpha_1 = 0$$

$$H_1: \alpha_1 < 0$$

The empirical model (equation 2) for the relationship between poverty and economic growth is specified based on the assumption that inequality may increase or decrease during the growth process although the growth elasticity of poverty is always negative when inequality is fixed.

5. RESULTS AND DISCUSSION

According to the theories on the relationship between poverty, inequality and growth, the extent and magnitude of absolute poverty depends on two factors: the growth of the mean level of real per capita income/expenditure and the degree of inequality in the distribution of income/expenditure. In general, at any given level of per capita income/expenditure, the more unequal the distribution of income, the greater is the incidence of poverty. Likewise, for any given pattern of income distribution, the lower the level of per capita income, the greater is the incidence of poverty.

To figure out the development outcome in terms of growth, poverty and inequality for the period 1995 to 2010, trends in real per capita household expenditure, the Gini coefficient and poverty incidence in ANRS are sketched in Fig. 3.

As can be clearly seen from the graph, poverty has significantly declined as the average expenditure per capita has increased. In terms of the relationship between growth and inequality, the phenomenon of high level of inequality with high level of expenditure per capita is evident from the figure. Minimal increase in expenditure per capita has resulted in a slight decline in the Gini magnitude during the period 2000 and 2005. On the contrary, higher growth over 1995 to 2000

and 2005 to 2010 resulted in higher magnitude of the Gini coefficient. The inverse relationship between poverty and growth is, however more discernible in the figure.

To quantify the influence of growth and inequality on poverty two panel data estimation techniques have been employed in this study for the main reason that there are significant differences among administration zones and even between urban and rural areas in ANRS.

F-test has been conducted for the FE model we estimated to find out whether it is applicable or not. The null hypothesis states that both dummy parameters, group and time, are equal to zero. The validity of the variables used in FEM can be checked through performing the F-test. The F statistic rejects the null hypothesis in favour of the fixed group effect (P<0.0033).

Similarly, the Breusch-Pagan LM test was carried out for the estimated random effects model (REM) to ascertain whether it can be applied or not. Breusch and Pagan's (1980) Lagrange multiplier (LM) test examines if individual (or time) specific variance components are zero. The null hypothesis states that the variance across group and time is equal to zero. With the chi-squared of 0.02, we accept the null hypothesis in favour of the FEM (P<0.8891).

Therefore, the results of the F-test and LM-test renders the estimates from the FEM are statistically preferable than the estimates from the REM. For that reason, without conducting the Hausman specification test we decide to employ the fixed effects model.

The gross growth elasticity of poverty shows the percentage change in mean annual household expenditure per capita, keeping inequality constant. It is quite possible, however, that inequality may increase or decrease during the growth process. Thus, it is essential to estimate the net elasticity of poverty to growth, which indicates the percentage change in poverty to a 1 percentage change in mean annual per capita household expenditure (APE). The result of the FEM, the statistically preferred model according to the relevant tests, is presented in Table 1.

The FEM fits the data well at the 0.05 significance level (F=5.54 and P<0.0033 for equation 1 and F=5.18 and P<0.0046). R-Square of .9387 for the first equation states that the model accounts for about 94 percent of total variance in the change in poverty. Similarly, the

R-square of .9448 for the second equation says that the about 95 percent of total variance in the change in poverty. The regression equations are,

$$\ln PoV_{it} = 12.3816 - 1.1217 \ln AEP_{it} + .4140 \ln GC_{it} \quad (3)$$

and

$$\ln POV_{it} = 10.8796 - .9736 \ln AEP_{it} \quad (4)$$

The growth elasticity of the poverty variable has its expected signs. The result in Table 1 show that growth has a significant negative relationship with poverty, keeping inequality fixed, whereas inequality has a significant positive relationship with poverty, holding growth constant. The result for the gross growth elasticity of poverty indicate that a 1 percent increase in mean per capita expenditure leads, on average, to a 1.1217 percent decrease in the proportion of people living below the determined poverty line, holding inequality constant (P<0.0000). This indicates that economic growth has led to reduction in poverty in ANRS over the past 15 years, implying that the various policies and reforms implemented in the region since 1995 have positively impacted the incomes of the poor. The table also show shows that a 1 percent rise in inequality in average expenditure per capita, keeping mean expenditure per capita constant, increases incidence of poverty by 0.4140 percent implying inequality has a positive but insignificant relationship with the incidence of poverty in the region. Moreover, the results imply that the growth elasticity of poverty is substantially larger than the inequality elasticity of poverty.

Table 1. Relationship between Poverty and Growth, FEM

Fixed effects model estimates		
	Equation 1	Equation 2
<i>lnAEP</i>	-1.1217*** (.1613)	-0.9736*** (.1381)
<i>lnGC</i>	.4140 (.2480)	
_Cons	12.3816*** (1.3350)	10.8796*** (1.0112)
F-test	5.54**	5.18**
DF	34	35
R ²	0.9387	0.9448
N	40	40

Source: Own Computation of 1995, 2000, 2005 and 2010 HICE surveys, ANRS

*Standard errors in parenthesis; **Statistical significance: *** Significant at 1% level and ** significant at 5% level

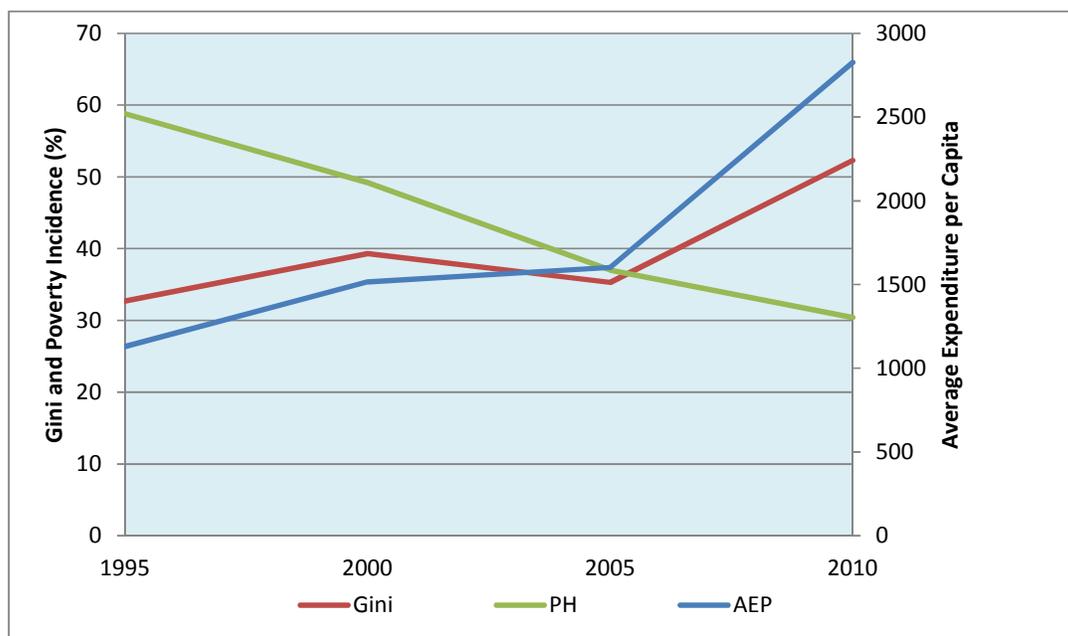


Fig. 5. Poverty, inequality and growth relationship (ANRS, 1995-2010)

Source: Own plot of 1995-2010 HICE survey computation result

Furthermore, estimation results for equation 2, in the same table, also show that growth has a negative and significant impact on poverty, keeping inequality flexible. This result suggests that the increase of every one percentage point in per capita household expenditure decreases incidence of poverty by .9736 percentage points in the region ($P < 0.0000$).

A comparison of the gross and net growth elasticities of poverty shows that the absolute magnitude of net growth elasticity of poverty (-0.9736) is smaller than that of the gross growth elasticity of poverty (-1.1217), implying that some of the effect of growth on poverty is lost due to the rise in inequality.

Findings of this study are consistent with the findings of De Janvry and Sadoulet [12], Odhiambo [19], Bigsten et al. [14], Tsai and Huang [16], Agarwal [18], Gelaw [20], Ijayat et al. [22], Young [21], Nuruden and Ibrahim [24] and Kolawole et al. [25]. Empirical findings from these studies indicated that economic growth has a negative and significant relationship with poverty which implies economic growth, in general, plays a pivotal role in poverty reduction.

6. CONCLUSION AND RECOMMENDATION

The study has estimated a FEM to determine the relationship between poverty and economic

growth in ANRS, Ethiopia, using a panel data from four household income, consumption and expenditure (HICE) surveys compiled between 1995/96 and 2010/11 by the Central Statistics Authority (CSA) of Ethiopia. The result shows that there is a significant negative relationship between poverty and economic growth in ANRS, Ethiopia.

The Fixed Effect estimation result shows that growth and change in inequality significantly affected the incidence of poverty in the region. The study has revealed growth contributes far more towards reducing poverty, keeping inequality constant, than the latter does to increasing poverty, holding the former constant.

The study also investigated the net effects of growth on poverty. The absolute magnitude of the net elasticity of poverty to growth is smaller than that of the gross elasticity of poverty to growth, implying that some of the growth effect on poverty is offset by the increase in inequality.

Results of the study have important policy implication in that appropriate measures need to be taken to reduce the existing inequality to achieve a pro-poor growth. Despite the fact that economic growth has contributed to reduction in poverty levels and improved standard of living in the region, the study has shown that income inequality is still a major constrain to that positive

relationship. In order to deal with poverty problems successfully, the issues of income inequality must also be dealt with. We propose that, government should implement policies that aim at redistributing income in favour of the poor and middle class households.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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