Relationship between Income Inequality and Economic Growth in Ethiopia

Tigist Girma*

Editor, Tutor and Assessor, St. Mary's University, P.O.Box 1211, Addis Ababa, Ethiopia.

Maru Shete

PhD and Associate Professor, St. Mary's University, P.O.Box 1211, Addis Ababa, Ethiopia

Abstract

The objective of this study is to investigate the relationship between income inequality and economic growth in Ethiopia. The study hypothesized the existence of long -run and short -run relationship between income inequality and economic growth. It used time series data for 2002 to 2017 and employed Auto Regressive Distributed Lag Model (ARDL) in a time series econometric framework. In the long-run co-integration analysis economic growth is found to be statistically significant, and if income inequality is increased by one percent, real GDP will grow by 13.8 percent. In the short-run, the error correction model was found to be statistically significant at 5% significance level with a negative sign implying that the error correction procedure converged monotonically to the equilibrium path relatively quickly and high significance of ECM (-1) is evidence to the existence of established stable long-run relationship between the variables. The positive relationship between income inequality and economic growth indicates that high income inequality followed the Kuznets hypothesis since Ethiopia is a low income country.

Keywords: *Economic Growth, Income Inequality, ARDL, ECM, Ethiopia.*

* Corresponding author and can be reached through tg2119b@gmail.com

1. INTRODUCTION

1.1 Background of the Study

The relationship between GDP and the distribution of income is an essential subject in macroeconomics (Galor, 2011). The function of income inequality plays in economic growth has additionally takes quite limit of attention in policy area and the press recently. According to Charles-Coll (2013), economic theories traditionally was targeted on issues like productiveness and efficiency, the role of income inequality in economic change has been present but not apparent for a long time. Economic growth is measured as the annual rate of increase in a country's gross domestic product (GDP). This is due to the fact high level of income inequality produces an unfavorable condition for economic growth and improvement (British Council, 2012). The center of attention on income inequality and economic growth starts in 1955 when Simon Kuznets presented his idea to the American Economic Association that of an inverted U relationship between per capita GDP and inequality in the distribution of income. He explained that the manner of economic growth had decreased income inequality in most countries by means of increasing per capita income, which came go together with labor movements from the agricultural to industrial sectors.

Field (1980) income inequality linked with three types of economic growth. The first one is modern-sector expansion growth where the economy develops through enlarging the modern sector. He grouped the modern area as industrialized sector that uses considerable amount of capital in production. Examples consist of advance economies and to some extent Asian economies like China and Taiwan. This type of growth will increase absolute incomes and reduces poverty levels. The impact of modern sector growth on income inequality in the initial stages depends upon whether the rich or the poor advantage from the increase in economic growth. As the modern sector expands, there is a redistribution of labor as workers move from the traditional sector or low income to the modern sector or upper income, and reducing income inequality and poverty levels. The second is modern-sector enrichment growth where growth is restricted to certain groups of people in the modern sector with the traditional sector experiencing little or no growth. Though this type of growth tends to raise average incomes and it leads to decreasing income inequality and few or no change in poverty levels. This type of growth has mostly exercise in Latin American and sub-Saharan African. The last sector is traditional sector enrichment growth which occurs when aggregate incomes will increase in the traditional or subsistent sector, with little or no income amplify in the modern sector. Field explained that countries with this type of growth achieve reductions in absolute poverty even at very low incomes because they focus policies on poverty reduction. This type of growth leads to a more equal distribution of income and a significant reduction in poverty levels.

1.2 Statement of the Problem

The Global Income Inequality Trend showed income inequality, on average, increased from 38.6% to 41.8% during the period 1990-2014 (Sudip, 2017). According to Bhorat *et al.* (2015) and Beegle *et al.* (2016) SSA countries has the second highest levels of income inequality next to Latin America and the Caribbean. Despite relatively high overall growth in recent years, inequality seems to have remained broadly unchanged, although there is quite a bit of variation across countries.

Ethiopia is a country which is one of the fastest developing economies in the world with GDP growing at 10.5 per cent per year since 2005 (Seid *et al.*, 2015) and targets to become a low middle-income country by 2025 (MoFED, 2015). Ethiopia has also managed to keep income inequality at a relatively lower level in the early 1990s (MoFED, 2013; World Bank Group, 2015). Despite this evidence on the state and path of inequality over the decade obtained from the national household income and consumption surveys pointed out that it has been clearly rising in urban areas, and remained more or less at its initial level in rural areas (Alemayehu *et al.*, 2009; Tassew *et al.* 2009).

The relationship between income inequality and economic growth is one of the most interesting, important and challenging areas in modern society (McKay, 2002). Alemayehu *et al.* (2009) showed strong correlation between growth and inequality. They further estimated that over ten years, as growth per capita increases by four percent, poverty would decline from forty-four to twenty-six percent, but with no change in the aggregate income distribution. Alemayehu & Addis (2014) also examined the relationship between growth, poverty and inequality in Ethiopia. They found growth and distributions as important determinants for change in poverty. In rural areas poverty reduction is totally accounted by growth (inequality was not significant).

Few studies have been done on this topic in Ethiopia. Most of them (see example, Tassew *et al.*, 2009; Alemayehu *et al.*, 2009; Alemayehu & Addis, 2014) studied about relationship between poverty, inequality and economic growth and are concentrated on relationship between poverty and growth. The empirical research carried out on the relationship between income inequality and economic growth in different countries showed contradictory findings with inconclusive outcomes. In a situation of inconclusive outcomes, there is a need to do more research in different contexts and inform policies for specific country contexts accordingly. This study is therefore an effort to fill up this lacuna in knowledge by investigating the relationship between income inequality and economic growth in Ethiopia using a macro level data and by adopting relevant analytical methodology.

2. LITERATURE REVIEW

2.1 Concept of Economic Growth and Income Inequality

Economic development takes place when there is accelerated economic growth accompanied by major changes in social structures, popular attitudes and national institutions, reduction of inequality and eradication of poverty (Todaro, 1994). Economic growth is a necessary condition but not sufficient to ensure social welfare (Mamoudou, 2011). Inequality is the degree to which distribution of economic welfare generated in an economy differs from that of equal shares among its nations (SID, 2004). According to Gehring & Kulkarni (2006), in a nation with perfect income equality, each and every individual has an equal share of the total income. This is opposite with perfect income inequality, where one individual has all of the total income. But neither of these extreme situations exists in any national economy.

2.3 Relationship between inequality and economic growth

During the 1970s, in the developed world, there was a growing concern with the quality of life, and which was manifested in protests against the consequences of economic growth, such as pollution and depletion of natural resources. In the developing world the main concern was focused on the relationship between economic growth and income distribution, since many countries that had experienced growth rates above their historical standards realized that such growth seemed to have negatively affected the income distribution, leading to increased inequality and a failure to eliminate the level of poverty (Todaro, 1994). In 1955s, Simon Kuznets formulated the most important contribution to the study of inequality which is known as the "inverted U-curve" hypothesis. Kuznets (1955) hypothesis suggests that, during a country's economic development, inequality rises at the initial stage and it declines as economy growth continuously which is resulted inverted U-shaped relationship between per capita income and income inequality. His primary example was the shift from the low-income agricultural sector to the high-income industrial sector but his theory can be applied to any major innovation or new technology.

Barro (1999) constructed theory on how growth can be affected. These theories can be classed into four broad categories such as; credit-market imperfections, political economy, social unrest, and saving rates. Credit market imperfection reflect balance information and limitations of legal institutions because creditors may have challenge in collecting on defaulted loans because law enforcement is imperfect. Higher inequality through credit-market imperfections thus reduces the possible economic output. Political economy perspective argues a greater degree of inequality motivates more redistribution through the political process especially transfer payments and the associated tax finance. High inequality motivates the poor to engage in crime, riots, and other disruptive activities and this participation represents a direct waste of resources because the time and energy of the criminals are not devoted to productive activities and destabilize the economy of the country. A rise in inequality tends to raise investment and then more inequality would enhance economic growth at least in a transitional sense and the saving rate provide an explanation why inequality could have a positive impact on economic growth. Galor and Moav (2004), on the other hand, provided a single theory in which the relationship between the distribution of income and growth is not stable over time. It rather depends on the stage of development in a country. The positive impact of inequality upon growth reflects the situation of an economy during its early stage of industrialization. At the early stage, the accumulation of physical capital is the principal engine of growth and it is promoted by inequality among people. Once the economy has passed the early stage, the accumulation of human capital becomes the prime engine of growth and a more equal distribution of resources allows more people to invest in education. Galor (2000) and Galor and Moav (2000, 2004) also suggested that the relationship between income inequality and growth depends on the stage of economic development or industrialization.

Aghion (1999) summarized three points why inequality has been seen to have an effects on growth. The first argument is the hypothesis of marginal propensity to save of the rich people is greater than that of the poor people. Second, in the separate investment and large sunk costs, the concentration of wealth is an important for the creation of new activities. The third argument is that the trade-off between equity and efficiency through incentives to workers. If output depends on the work effort of agents and an equal distribution of wages might discourage them from making any additional effort and thus reduce the efficiency of the production system (Mirrlees, 1971). Clark (1995) argued that the nations experiencing high rates of income inequality are less developed countries and developing countries. It has been argued that in the future, income inequality and the accumulation of wealth in a small proportion of individuals would result in higher growth. On the other hand, Alesina and Rodrik (1991) and Persson and Tabellini (1990) argued that inequality actually slows growth. This is because increased inequality causes greater conflict over distributional issues, thereby encouraging greater government intervention into the economy and higher taxes.

Perotti (1996) summarized the arguments why income inequality will be harmful for economic growth. The first argument is that an unequal distribution of income will lead to pressure for redistribution through distortionary taxes and incase reducing growth. The second argument is that inequality may lead to sociopolitical instability, which will in turn reduce investment and hence growth. The third argument is that in the presence of imperfect capital markets inequality will reduce investment in human capital, which will in turn reduce growth. The fourth and final argument is that as inequality increases, fertility is likely to rise and human capital investment fall, both reducing growth.

2.4 Empirical Evidences on the Relationship between Inequality and Growth

Studies are conducted to examine the relationship between income inequality and economic growth for cross country differences, in both developed and developing countries. The findings are, however, mixed: positive, negative, no interaction and following Kuznets curve. Tian (2012) investigated the relationship between income inequality and economic growth in China by using OLS method using 22 years data from 1985 to 2007. The results showed that income inequality had negative impact on economic growth rate. Along with this effect, it achieved the expectation that increased income inequality results decreased saving rate and decreased GDP growth rate. Barro (1999) with evidence from a broad panel of countries showed little overall relationship between income inequality and rates of growth and investment. The study suggested that income inequality have positive effects for high level income but negative for low income per capita. Shin (2012) used heterogeneous agent growth model and found that in the early stage of economic development. Dahan and Tsiddon (1998) investigated the dynamic interactions among demographic transition, income distribution, and economic growth. They showed that fertility and income distribution followed an inverted U-shaped dynamics in the process of economic development. Voitchovsky (2005) analyzed the influence of the shape of income distribution on economic growth for a panel of 25 countries, and claimed that inequality within a country is positively correlated to growth at the top quartiles of the distribution, but negatively linked at the lower end of the distribution.

Medgyesi and Toth (2009) analyzed the different growth effects on the distribution of labour incomes by using a high-productivity modern sector and a low-productivity/low-wage sector. They argued that when employment increases with the same proportion, growth does not necessarily change income distribution. Gelaw (2009) analyzed the relationship between poverty, inequality and growth in rural Ethiopia and he argued that change in inequality significantly affected the poverty gap in Ethiopia. Hsing (2005) examined the relationship between income inequality and economic growth by incorporating investment and human capital in economic growth function in the US. The results showed income inequality retarded economic growth while investment and human capital stimulated it. Jong (2010) used the data set of Forbes (2000) and applied dynamic panel technique. The result showed that long term economic growth is inversely affected by income inequality. In the short term to the medium term, income inequality affects economic growth but impact is uncertain and same is true from sub-group analysis. Fields (1988) used cross-sectional data, inter -temporal data, and micro data states that considering the two possible conclusions, that are income inequality must increase before it decreases and the other one is that income inequality may increase or decrease depending on the type of country and the policies pursued. Herzer and Vollmer's (2012) study on 46 countries by using a panel co-integration analysis showed on average income inequality has a negative long-run influence on economic growth. Castelló-Climent (2010) applied the GMM approach and showed that income inequality leads to human capital inequality that in turn retards economic growth. Binatli (2012) examined the relationship between income inequality and per capita income during the periods of 1970–1985 and 1985–1999. The results showed positive impact of income inequality on economic growth in the nineties and negative effect of income inequality in the seventies. Zouheir and Imen (2012) examined the nexus between income inequality and economic growth using data from North African countries. They found that high income inequality is harmful for economic growth but trade openness and physical and human capital investment enhanced economic growth. Malinen (2013), investigated the relationship between inequality and growth in 70 OECD and non-OECD countries using GMM estimation technique and found a negative relationship between inequality and growth.

Fawaz *et al.* (2014) discovered that high-income developing countries (HIDCs) and low-income developing countries (LIDCs) showed different relationships. The HIDCs showed a positive relationship between economic growth and inequality, while the LIDCs possessed a relationship opposite of the HIDCs. As economic growth increased, then income inequality decreased. Lee *et al.* (2015) have argued that the long-held view that inequality was an inevitable outcome of structural transformation had been based on a partial reading of Kuznets. Reducing inequalities in the context of structural transformation is not automatic. Rather, it is a matter of social and political choice, and robust policies. UNDESA (2013) supported that inequality decrease much depends on country-specific conditions and national policies.

Betselot (2015) investigated the relationship between income inequality and economic growth in Ethiopia by using secondary data for 1981/82-2013/14 using Auto Regressive Distributed Lag Model. She argued that in the long-run economic growth is significantly and negatively related to income inequality.

2.4 Conceptual Framework

Theoretically, income inequality within nations rises in the early stages of economic growth, becomes more pronounced at intermediate levels of development, and decreases thereafter as countries become wealthy (Galor, 2000; Galor & Moav, 2000 & 2004; Kuznets; 1955). Based on the literature, the study has developed the following conceptual framework.

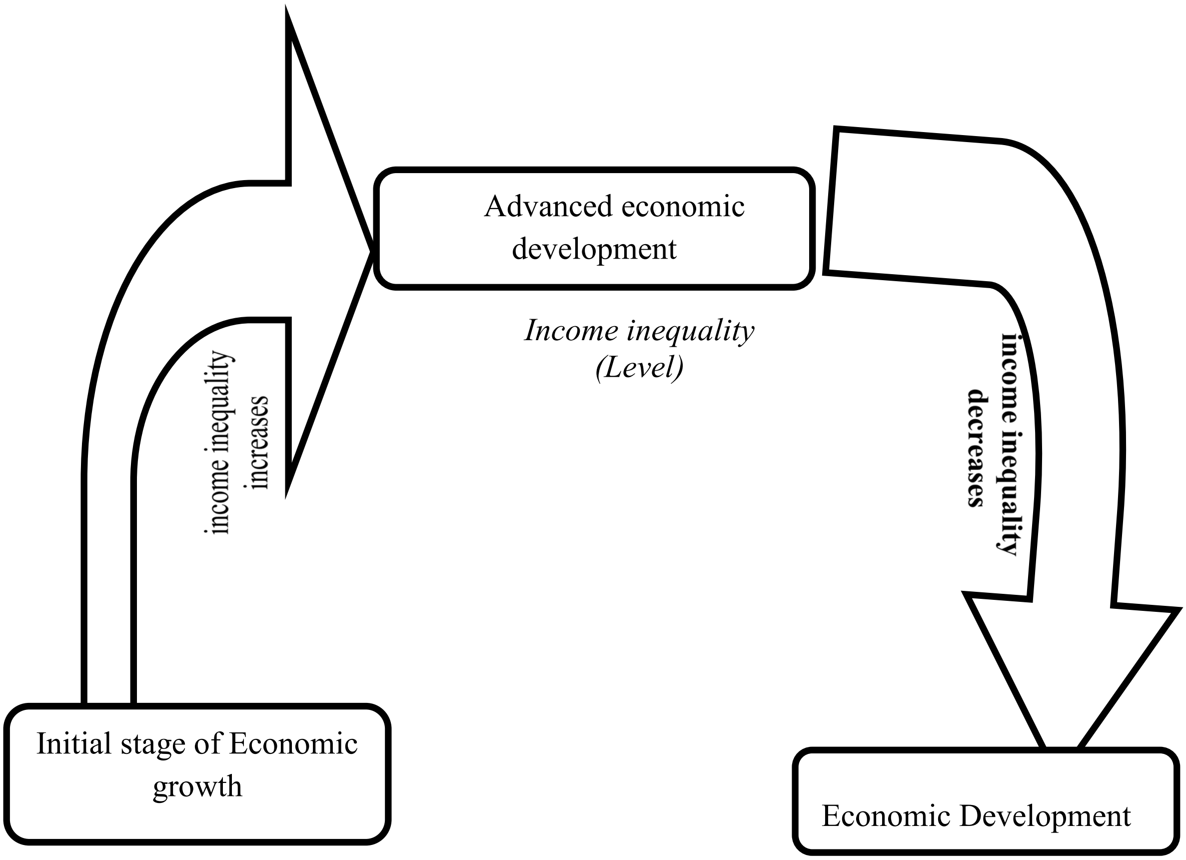

Figure 1: Conceptual framework of the study

Source: Authors' construction based on literature (2018)

3. RESEARCH METHDOLOGY

3.1 Research Approach and Design

Quantitative research approach involves the collection of data which involves data collection that is typically numeric and tends to use mathematical models as the methodology of data analysis (Leedy & Ormrod, 2001; Creswell, 2003). The descriptive research design is a basic research method that describes the situation as it exists in its current state. Causal research design helps to examines how the independent variable are affected by the dependent variables and involves analysis of cause and effect relationships between the variables (Vogt, 1999). The study employed a quantitative type of research approach as well as both descriptive and causal research design as they are appropriate to achieve its objectives.

3.2 Data Source, Description of Variables and Hypothesis

The research used secondary data collected from National Bank of Ethiopia (NBE) and the World Bank (WB) dataset. The study covered the time period from 2002 to 2017 by using time series data from different sources. Real GDP, which is the total market value or monetary value of all finished goods and services produced in a country borders in a specified time period and calculated on annual basis, was collected from NBE. Income inequality, measured using the GINI coefficient been collected from the World Bank Database. In view of the fact that Ethiopia is a low income country, according to Kuznets (1955), positive relationship between inequality and economic growth is expected.

3.3 Methods of Data Analysis

The collected data were analyzed by using both descriptive and econometric method. Descriptive statistical methods which are used to describe the variables are presented using graphs and tables. Econometrics tools and techniques were used to do necessary diagnostics tests, and to explain long-run and short-run relationship between economic growth and income inequality. The econometric tools were estimated using Eviews 9 application software. The analysis of long run and short run relationship between income inequality (GINI coefficient) and economic growth (Real GDP) can be computed by sing Autoregressive Distributed Lag (ARDL) model. Pesaran and Shin (1999) introduced the ARDL model to co-integration and error correction depending on the degree of stationary levels of the variables. This method has certain econometric advantages as compared to other co-integration procedures. The first one is, it is applicable irrespective of the degree of integration of the variables (i.e., whether the variables are purely I(0), I(1) or mixture of both) which avoids the pre-testing problems associated with standard co-integration, which requires that the variables be already classified into I(1) or I(0) or mixture of both (Pessaran *et al.*, 2001). Secondly, the long run and short run parameters of the model are estimated simultaneously since it takes into account the error correction term in its lagged period. Third, with the ARDL approach it is possible that different variables have different optimal numbers of lags of the order of integration of the variables. The fourth advantage is, the ARDL approach is more robust and performs better for small sample sizes and by applying the ARDL technique we can obtain unbiased and efficient estimators of the model (Narayan, 2004). Mathematically, the model is presented below.

The ARDL *(p, q1, q2......qk)* model specification is given as;

$$\Phi\,(L, p)\, yt = \sum_{i=1}^{k} \beta_i\,(L, q_i) x_{it} + \delta w_t + \mu_t ut \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .(1)$$

Where: $\Phi\,(L, p) = 1 - \Phi 1L - \Phi_2 L^2 - \ldots . - \Phi_p L^p$

$\beta(L,q) = 1 - \beta_1 L - \beta_2 L^2 - \ldots . - \beta_q L^q$, *for* $i=1,2,3\ldots\ldots .k$, $\mathbf{u}_t \sim iid(0;\delta^2)$.

L is a lag operator such that $L^0 y_t = X_t$, $L^1 yt = y_{t-1}$, and w_t is as x1 vector of deterministic variables such as the intercept term, time trends, seasonal dummies, or exogenous variables with the fixed lags. $P=0,1,2\ldots,m$, $q=0,1,2\ldots.,m$, $i=1,2\ldots.,k$: namely a total of $(m+1)k+1$ different ARDL models. The maximum lag order, m, is chosen by the user. Sample period, $t = m+1, m+2\ldots., n$.

Or

The ADRL (p, q) model specification:

$$\boldsymbol{\Phi}\ (L)\ yt = \boldsymbol{\varphi} + \boldsymbol{\theta}\ (L)\ xt + \mu_t, \ldots\ldots(2)$$

With

$$\boldsymbol{\Phi}\ (L) = 1 - \boldsymbol{\Phi}_1 L - \ldots - \boldsymbol{\Phi}_p L_p,$$

$$\boldsymbol{\theta}\ (L) = \boldsymbol{\beta}_0 - \boldsymbol{\beta}_1 L - \ldots - \boldsymbol{\beta}_q L^q.$$

Hence, the general ARDL *(p, q1, q2......qk)* model;

$$\Phi\ (L)y_t = \boldsymbol{\varphi} + \boldsymbol{\theta}_1(L)x_{1t} + \boldsymbol{\theta}_2(L)x_{2t} + \boldsymbol{\theta}_k(L)x_{kt} + \mu_t \ldots\ldots(3)$$

Using the lag operator L applied to each component of a vector, $L^k y = y_t - k$, is convenient to define the lag polynomial $\Phi(L,p)$ and the vector polynomial $\beta(L,q)$. As long as it can be assumed that the error term u_t is a white noise process, or more generally, is stationary and independent of *xt, xt-1, … and yt, yt-1, …,* the ARDL models can be estimated consistently by ordinary least squares.

Given the above model specification, model for the study is rendered as the form:

$$\boldsymbol{\Phi} \ln Y_t = \beta_o + \beta_1 \ln x_{1t} + \beta_2 \ln x_{2t} + \beta_3 \ln x_{3t} + \ldots\ldots + \beta_{ki} \ln x_{kt} + \varepsilon_t \ldots\ldots (1)$$

$$\boldsymbol{\Phi} \ln RGDP_t = \beta_o + \beta_i \ln GINI_t + \varepsilon_t \ldots\ldots (2)$$

Where: $\ln RGDP_t$ - Natural logarithm of real GDP

$\ln GINI_t$ - Natural logarithm of inequality

β_o – Constant and β_1 are partial regression coefficients

ε_t- Error term

t- Time trend to capture the effect of time

The study employed OLS estimation procedure for the regression parameters. Thus, the general ARDL structure for two variables (Y_t and X_t) can be expressed as follows:

$$Y_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{j=0}^{n} \beta_j X_{t-j} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(3)}$$

The OLS estimation of the ARDL model of the variables in this study is presented as:

$$\Delta \ln RGDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta \ln RGDP_{t-1} + \sum_{i=0}^{n} \alpha_{2i} \Delta \ln GINI_{t-1} + \beta_1 \ln RGDP_{t-1} + \beta_2 \ln GINI_{t-1} + \varepsilon_t \quad \ldots\ldots \text{(4)}$$

The left-hand side is Economic Growth; which is real GDP, the expressions (β_1 and β_2), correspond to the long-run relationship and the remaining expressions with the summation sign represent the short-run dynamics of the model. The null hypothesis of no co-integration in the long-run between the variables in the above equation is:

$Null\ hypothesis\ (H_0)$: $\beta_1 = \beta_2 = 0$ (no long run relationship among the variables) against the alternative one:

$Alternative\ hypothsis\ (H_1)$: $\beta_1 \neq \beta_2 \neq 0$. The F-test has no standard distribution which depends on whether the variables include in the model are I(0), or I(1), the numbers of repressors', and whether the model contains an intercept and/or a trend (Narayan, 2004). To test the significance of lagged level of the variables under consideration, the appropriate statistic is F or Wald test as Pesaran *et al.* (2001) proposed for bound test approach will be applied. The short run Error Correction Model (ECM) integrates the short-run dynamics with the long-run equilibrium without losing long-run information. After testing the existence of a long run relationship between the variables through the Bound Testing, a short run error correction model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee *et al.,* 2003). The error correction model is a short-run dynamic model, consisting of differenced variables, except the error correction term. The error correction term reflects the difference between the dependent and explanatory variable, lagged one time period. This model can incorporate a number of lags on both the dependent and explanatory variables. The diagnostic and the stability tests are conducted to ascertain the adequacy of the ARDL model. Many economic and financial time series exhibit trending behavior or non-stationery in the mean. Therefore, it is necessary to test the stability of the series before identification of the relationship between variables.

1) Stationary (Unit Root) Diagnosis: A time series is said to be stationary if its mean and variance are constant over time and the value of covariance between the two periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed. (Gujarati, 2004). Time series data are rarely stationary in level forms. Regression involving non-stationary (I.e., variables that have no clear tendency to return to a constant value or linear trend) time series are lead to the problem of spurious regression. This occurs when the regression results reveal a high and significant relationship among variables but no relationship exist in fact. Stock and Watson (1988) have shown that the usual test statistics (t, F, DW, andR^2) will not possess standard distributions if some of the variables in the model have unit roots. The other precondition for testing unit root test when we applying ARDL model is to check whether the variables enter in the regression are not order two (I.e. I(2)). So, it is necessary to test for time series variables before running any sort of regression analysis because it affects the estimation procedures. In general non-stationarity can be tested using Augmented Dickey-Fuller (ADF) test, Phillips Perron (PP) test and Kwiatkowski- Phillips-Schmidt-Shin (KPSS) test. However, to ensure reliable result of test for stationarity, this study employs both Augmented Dickey-Fuller (ADF) test and Philip-Perron (PP) tests.

2) Heteroscedasticity and Stability Test: The diagnostic test examines the serial correlation, normality distribution of the residuals, functional form and heteroscedasticity associated with the model. The stability test employs the cumulative sum of squares of recursive residuals (CUSUMSQ) and the cumulative sum of recursive residuals (CUSUM) and examines the structural stability of the model.

4. RESULTS AND DISCUSSION

4.1 Results of Descriptive Statistics

The descriptive statistics describes the basic futures of the data in a study. It provides simple summaries about the sample and the measures and a better look about the variables by summarize the statistical properties of the series in the model. Table 1 presents the statistical summary of income inequality and real GDP for the period under consideration. With the average (mean) value of 439422.8, the dependent variable (real GDP) has minimum and maximum values of 197604.4 and 803357.4 respectively. The mean, minimum and maximum value of GINI is 0.32, 0.29 and 0.391. The implications of the high range, is that the presence of out layers which in turn affects the mean value of data. The standard deviation of RGDP and Gini is 200890.1and 0.030 respectively, which shows the actual observation of the RGDP is highly dispersed from the mean values while GINI has lowest standard deviation of 0.03 implies its mean value and actual observations are close each other.

Table 1: Descriptive statistics for Dependent and Independent Variables

Statistics	Variables	
	RGDP	GINI
Mean	439422.8	0.32
Median	399290.1	0.31
Maximum	803357.4	0.39
Minimum	197604.4	0.29
Std. Dev.	200890.1	0.03
Observations	16	16

Source: Authors' estimation based on NBE and World Bank data sets (2018)

According to Todaro (2012) the Gini coefficient for countries with highly unequal income distributions typically lies between 0.50 and 0.70, relatively equal distributions, it lies between 0.20 and 0.35 and it is approximately 0.44 for a relatively unequal distribution. The average (mean) value of GINI in Ethiopia which is 0.32 lies between 0.20 and 0.35, represents there is relatively equal distributions.

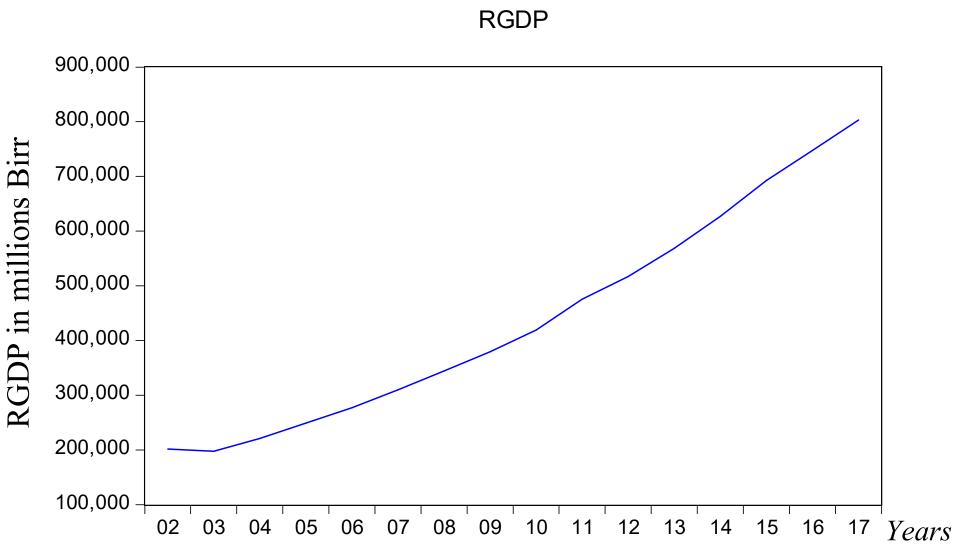

Figure 1: Trends of Total real GDP in Ethiopia from 2002−2017

Source: Authors' computation based on NBE data (2018)

According to NBE, the real GDP of Ethiopia was 201,840.04 million birr in 2002 and it reaches 803357.42 million birr in 2017. Figure 1 above showed that from 2002 to 2017 the graph is sharply upwards that indicates higher rate of growth. This unprecedented high growth rate is attributed due to a combination of pro poor growth policy (since 2003 on wards) and state led development program (since 2005 on wards) and the present government implementing a development program aimed at poverty reduction through rapid economic growth and macroeconomic stability (Zerayehu 2013).

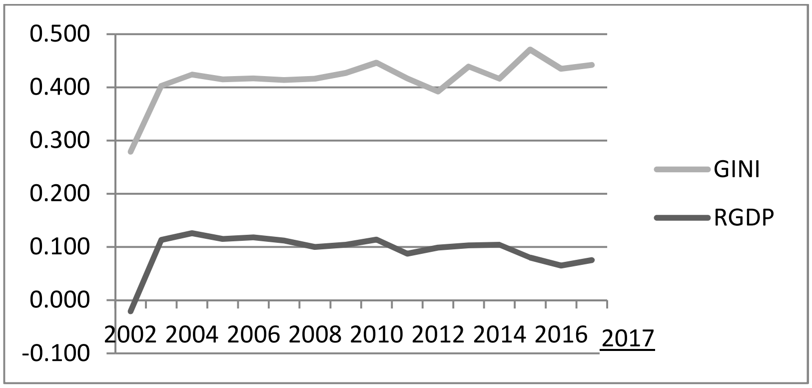

Figure 2: Trends of GINI coefficient and growth rate of RGDP

Source: Authors' computation based on World Bank data and NBE (2018)

The trend of income inequality (GINI) and growth rate of real GDP relatively low at starting year and shows increase. Figure 2 illustrates the same properties that increase or slight decrease at the same periods. This shows positive relationship between GINI and RGDP. Therefore according to Kuznets hypothesis an increase in income inequality as economy growth at initial stage, Ethiopian income and growth relationship follows Kuznets hypothesis. Since Ethiopia is a low income country.

4.2 Results of Econometric Analysis

1) Results of Unit Root Test

Most macroeconomic time series are trended and therefore in most cases are non-stationer. In order to receive consistent, reliable results, the non-stationary data needs to be transformed in to stationary data. Unit Root test is used to make the data stationary. So before to utilizing the data in estimating ARDL model, it is very important to check the time series properties of each series. When a series contains unit root, it is common to transform the variables through differencing so as to make it stationary. In order to determine the degree of integration, a unit root test is carried out using the standard Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests. Moreover in applying ARDL model all of the variables should be integrated of order zero (I (0)), integrated of order one I (1) and a mixture of two. But it should not be integrated of order two (I (2)). To check these conditions, unit root test is conducted before any sort of action taken. Therefore the unit root test could convenience us whether or not the ARDL model should be used. The result in table below shows that there is I (1) but not any order two.

Table 2: ADF Unit Root Test Results

Variables (At level & 1st difference (D))	With intercept only		Test critical values:			With intercept and trend		Test critical values:		
	t-statistics	Prob	1% level	5% level	10% level	t-statistics	Prob	1% level	5% level	10% level
LNRGDP	0.23	0.97	-3.96	-3.08	-2.68	0.67	0.99	-4.89	-3.83	-3.36
D(LNRGDP)	-8.24	0.00	-4.0	-3.10	-2.69	-3.04	0.16	-4.99	-3.88	-3.39
LNGINI	-0.04	0.94	-3.96	-3.08	-2.68	0.71	0.99	-4.89	-3.829	-3.36
D(LNGINI)	-7.35	0.00	-4.0	-3.10	-2.69	-3.23	0.13	-4.99	-3.875	-3.39

Source: Authors' estimation based on NBE and World Bank data sets (2018)

Based on the above ADF Unit root test result, both variables are stationary in first difference. This result indicates that, none of the variables are I (2).

Similarly, the PP test shows that both variables are stationary in first difference. Form table 2 and 3 we can conclude that none of the variables entered in the regression are order two, which are not desire in applying ARDL model. So ARDL co-integration technique proposed by Pesaran *et al.* (2001) is the most appropriate method for estimation or to check the long run relationship among the variables.

Table 3: Phillips-Perron test statistic test (unit root test) results

Variables (At level & 1st difference (D))	With intercept only		Test critical values:			With intercept and trend		Test critical values:		
	Adj. t-Stat	Prob	1% level	5% level	10% level	Adj. t-Stat	Prob	1% level	5% level	10% level
LNRGDP	0.25	0.97	-3.96	-3.08	-2.68	-4.01	0.03	-4.73	-3.76	-3.33
D(LNRGDP)	-7.48	0.00	-4.06	-3.1	-2.69	-30.55	0.00	-4.80	-3.80	-3.34
LNGINI	-0.02	0.94	-3.96	-3.08	-2.68	-3.20	0.12	-4.73	-3.76	-3.33
D(LNGINI)	-6.15	0.00	-4.0	-3.1	-2.69	-35.20	0.00	-4.80	-3.79	-3.34

Source: Authors' estimation based on NBE and World Bank data sets (2018)

2) ARDL Bound Tests for Co-integration

After checking the stationarity of the variables, the next step is checking the bound test for co-integration. The first task in the bounds test approach of co-integration is estimating the ARDL model using the appropriate lag length selection criteria. A maximum lag of order 1 was automatically chosen for the conditional ARDL model. Because according to Pesaran and Shine (1999) for the annual data are recommended to choose a maximum of one or two lag lengths. In addition the stationarity of the results confirmed that both variables were of order 1 and according to Wooldridge, (2000) the more lags we include, the more initial values we lose. The F-test through the Wald test (Bound test) is performed to check the joint significance of the coefficients. . Then Wald (bound test) is performed and the value for F-statistic obtained. The computed F-statistic value is compared with the lower bound and upper bound critical F-values that have been provided by Pesaran *et al.* (2001) and Narayan (2004). As it is indicated in Table 4.

Table 4: Results of the ARDL Bound Test

Test Statistic	Value	K	Critical Value Bounds		
			Significance	I0 Bound	I1 Bound
F-statistic	100.9355	1	10%	4.04	4.78
			5%	4.94	5.73
			2.50%	5.77	6.68
			1%	6.84	7.84

Source: Authors' estimation based on NBE and World Bank data sets (2018)

As indicated in the above table, the calculated F-statistic i.e. 100.9 is higher than the upper bounds of the critical values at all significance levels. Since the computed F-statistics is greater than the upper bound critical value, it implies that it rejects the null hypothesis (H_0= No long run relationship exist among the variables) and accepts the alternative hypothesis (Long run relationship exists).

3) Model Stability and Diagnostic Test

From Table 5 the test for serial correlation is the Langrangian Multiplier (LM) test for autocorrelation, the test for functional form is Ramsey s RESET test, the test for normality is based on a test of skewness and kurtosis of residuals and the test for a hetroskedasticity is based on the regression of the squared residuals on square fitted values. Table 5 indicates that the long run ARDL model estimated in the study passes all the diagnostic tests. This is because the p-values associated with both the LM version and the F version of the statistics was unable to reject the null hypothesis specified for each test.

Table 5: Results of Diagnostic Test

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(2)= 2.378143[.3045]	F((2,12)= 1.047497[.3808]
B:Functional Form	CHSQ(1)= 2.585998[0.1078]	F(1, 13)= 2.280450[.1549]
C:Normality	CHSQ(2)= .079476[.961041]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .330476[.5654]	F(1,14)= .295265[.5954]

A: Lagrange multiplier test of residual serial correlation

B: Ramsey's RESET test using the square of the fitted values

C: Based on a test of skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values

Source: Authors' estimation based on NBE and World Bank data sets (2018)

The first test is answers the question whether there is or not an interdependence/correlation between the two residuals. This is called an autocorrelation test. The Brush God Fray LM test failed to reject the null hypothesis because the p-values associated with test statistics is greater than the 5% standard significance level (i.e. 0. 3045 > 0.05). This implies that there is no problem of autocorrelation in the model. Secondly, the results of the Ramsey's RESET test, which tests whether the model suffers from omitted variable bias, showed that the model is correctly specified (see Table 5). The third test is about the nature of distribution of the residual. Since the p-value associated with the Jaque-Berra normality test is larger than the standard significance level (i.e. 0.96 > 0.05), we fail to reject the null hypothesis. The last diagnostic test deals about the variance nature of the residual i.e. hetroskecedasitcity test. The null hypothesis is constant variance of the residual or homoskecedasitcity as we observed from the above table the p-value of the test statistics is higher than the associated significance level (i.e.

0.57 > 0.05), then we fail to reject the null hypothesis. Therefore, it can be concluded that there is no specification error.

4) Stability Tests (Plot of CUSUM and CUSUMQ)

The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of residuals (CUSUMQ) plotted against the critical bound of the 5% significance level which shows that the model is stable overtime. The stability of the long run coefficients is used to form the error correction term in conjunction with the short run dynamics. Having this in mind, in this study the CUSUM and CUSUMQ tests which are developed Brown et al. (1975) are conducted. CUSUM test is based on the first set of n observations.

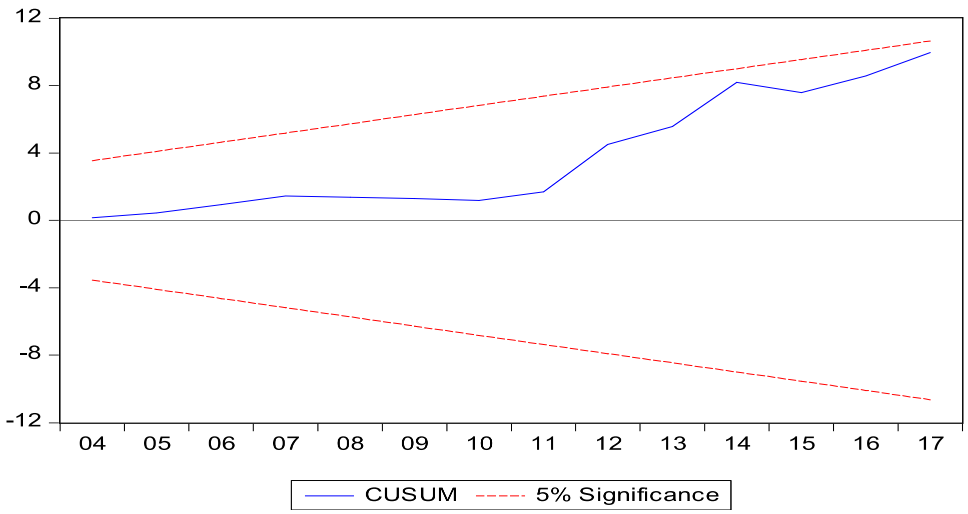

Figure 3: Plot of Cumulative Sum of Recursive Residuals (CUSUM)

Source: Authors' estimation based on NBE and World Bank data sets (2018)

If the plot of CUSUM stays within 5% significance level, then estimated coefficients are said to be stable which is similar to carry out the CUSUMQ that is based on the squared recursive residuals. Depending on the plotted graph, one can identify at what point of time a possible instability (structural break) occurred. If the plot of CUSUM and CUSUMQ statistic moves without crossing the straight lines, then the estimated coefficients are said to be stable.

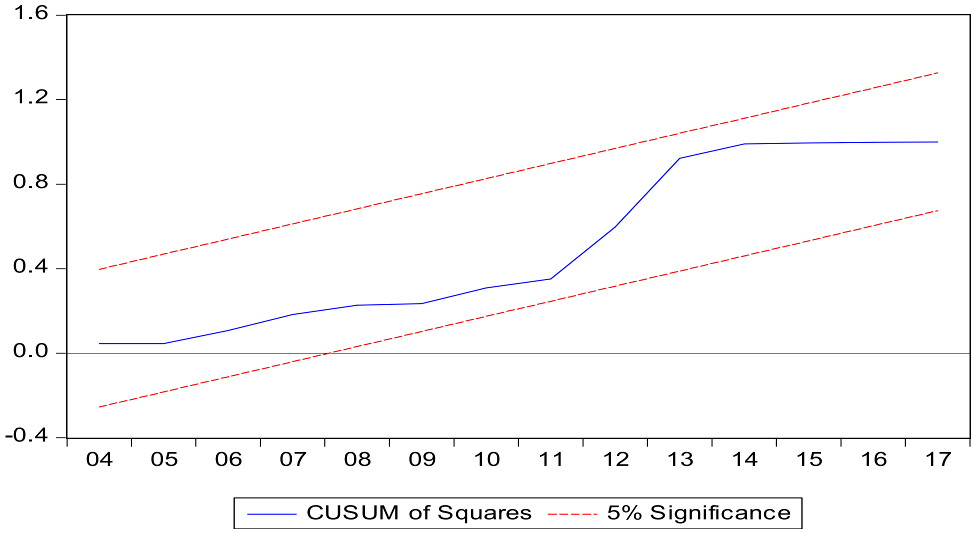

Figure 4: Plot of Cumulative Sum of squares of Recursive Residuals
Source: Authors' estimation based on NBE and World Bank data sets (2018)

As the above figure indicates both CUSUM and CUSUMQ test statistic for the model did not cross the critical value lines, so it is safe to conclude that the model is stable. Accordingly, the results of the estimated model are reliable and efficient.

4.2. Estimation Results of Econometric Model

1) Long Run Relationship between Economic Growth and Income Inequality

After testing the bound test for integration the next step is long run model estimation. The results of the bound test indicates us the existence of a long run relationship between Gini coefficient and real GDP. The estimated long run ARDL model is presented in table 6.

Table 6: Results of ARDL Long-run Estimation

ARDL(1,1) selected based on Akaike Information Criterion			
Dependent variable is LNRGDP			
16 observations used for estimation from 2002 to 2017			
Regressor	Coefficient	Standard Error	t-Ratio [Prob]
LNGINI	13.76	0.39	35.55(0.000)
C	-22.23	0.97	-22.89(0.000)

Source: Authors' estimation based on NBE and World Bank data sets (2018)

According to the result from the long run test statistics, gini coefficient is significantly and positively related to real GDP. In case it follows Kuznets hypothesis since Ethiopia is a low income country, so the income inequality and economic growth rise at the same time. Since the researcher has specified the growth model in a log-linear form, the coefficients of the dependent variable is interpreted as elasticity with respect to real GDP. The long run model result indicates that Gini coefficient is statistically significant at 1% significance level. Since the coefficient of Gini is 13.8%, which is the income inequality elasticity of Real GDP. Thus, holding other things constant a one decrease in income inequality will decrease 13.8% real GDP. The finding of the study is similar to the findings of by Perotti (1996), Forbes (2000), Delbianco *et al.* (2014) and Lee *et al.* (2015). Based on the above result, the estimation equation becomes:

$$\text{LnRDP} = -22.23 + 13.\ 76\ln\text{GINI}$$

2) Short-Run Error Correction Model

After the acceptance of long run coefficients of the growth equation the short run Error Correction Model (ECM) is estimated. ECM indicates the speed of adjustment to restore equilibrium in the dynamic model. It is one lagged period residual obtained from the estimated dynamic long run model. The coefficient of error correction term indicates how quickly variables converge to equilibrium. Moreover it should have a negative sign a statistically significant at standard significant level (i.e. p- value should less than 0.05). The result presented in Table 7 shows that the value of ECM (-1) is statistically significant at the 5% significance level with negative sign which implies that the error correction process converges monotonically to the equilibrium path relatively quickly and such very high significance of ECM (-1) is further proof of the existence of established stable long run relationship between the variables (Banerjee *et al.*, 2003).

Table 7: Error Correction Representation for the selected ARDL model

ARDL(1, 2, 1, 0) selected based on Akaike info criterion (AIC)				
Dependent variable is D(LNRGDP)				
16 observations used for estimation from 2002 to 2017				
Regressor	Coefficient	Standard Error	T-Ratio	[Prob]
D(LNGINI(-1))	26.87**	6.85	3.92	0.01
ECM(-1)	-0.37**	0.09	-3.99	0.01
C	-1.28	0.42	-3.02	0.03
R-squared = 0.956429 Adjusted R-squared = 0.880180 F-statistic = 12.54347 Prob(F-statistic) = 0.013891				

Source: Authors' estimation based on NBE and World Bank data sets (2018)
Note: the coefficients are statistically significant at 5%.

The equilibrium error correction coefficient is equal to -0.37 implies that approximately 37% of the disequilibrium from the previous year's shock converges back to the long-run equilibrium in the current year. Since, its coefficient has the correct negative sign and significant at 5% level, it results in a very high speed of adjustment to equilibrium after a shock. As it is shown in the result table, similar to the long run coefficients, the main variable, i.e, the Gini coefficient is positively related to RGDP. The coefficient of determination (R-squared) is high explaining that about 95.64% of the variation in the real GDP is attributed or explained by the variations of the variable that is used in the model. In addition the F-statistics is significant that shows the model is good to explain the relationship between the variables in the short run.

5. CONCLUSION

The main objective of this study is to investigate the relationship between income inequality and economic growth in Ethiopia ranging the time from 2002 to 2017. The study have investigated the long run and short run relationships between income inequality and real GDP by using Autoregressive Distributed Lag (ARDL) model to co-integration bound test approach to error correction. Before applying the ARDL model, all variables are tested for their time series properties (stationary properties) using ADF and PP tests. ADF test result shows the variables are stationary at their first difference and the PP test indicates the same as ADF test. This confirms the reason why the researcher uses ARDL model. As we have seen from the finding part a one percent increase income inequality will increase real GDP will grow by 13.76 percent and 26.87 percent in the long run and short run respectively during the study period. The short run error correction model (ECM) formulation reveals that there is convergence towards equilibrium in the long run and the adjustment is fairly strong(36.62%) per annum and statistically significant.

According to Kuznets (1955) in the early stages of economic growth inequality within nations rises as economy growth. That means there is positive relationship between income inequality and economic growth and also he explained that the process of economic growth had reduced income as labor shifts from the agricultural sectors to industrial sectors. From the above finding result income inequality and economic growth are positively related, which is the same to the Kuznets hypothesis. Therefore the relationship between income inequality and economic growth in Ethiopia follows the Kuznets curve since Ethiopia is a low income country whose economy is dominated by agriculture and targets to become a low middle-income by transform the country into a manufacturing hub.

REFERENCES

Alemayehu G. & S. Abebe & J. Weeks (2009). Growth, Poverty and Inequality in Ethiopia: Which way for Pro-Poor Growth? *Journal of International Development, J. Int. Dev*. 21: 947–970.

Alemayehu G. & Y. Addis (2014). Poverty and Inequality in Ethiopia for the period 2000-2013: A Macroeconomic Assessment. Available at: *https://www.alemayehu.com/AA%20Recent%20Publication/PEconGrwothEthALEMAYEHU-%20Final%20Edited%20Ver%2011MayG_NTchange_ShortVer.pdf*

Banerjee A., J. Dolado, J. Galbraith, & D. Hendry (2003). Co-integration, Error Correction, and the Econometric Analysis of Non-stationary Data: Advanced Text in Econometrics New York: Oxford University press.

Beegle, K., L. Christiansen, A. Dabalen & I. Gaddis (2016). Poverty in a Rising Africa: Overview. World Bank, Washington.

Bhorat, H., K. Naidoo & K. Pillay (2015). Growth, Poverty and Inequality Interactions in Africa. An Overview of Key Issues. Mimeo, Inc.

Boccanfuso, D. & T.S. Kabore (2000). Economic and Quantitative Poverty Analysis, the Panso Institute West Africa, Senegal, Dakar.

British Council (2012). Gender in Nigeria report 2012: Improving the lives of girls and women in Nigeria. Nigeria: British Council.

Charles-Coll, J. A. (2013). Inequality in the context development theories: Dependencia theory and Washington Consensus. *Journal of Economics and Behavioral Studies*, 5(10): 687-695.

Field, G. (1980). Poverty, Inequality and Development, Cambridge University Press, 46-56.

Galor, O. (2011). Inequality, Human Capital Formation, and the Process of Development. Brown University working papers 2011-7.

Kuznets, S. (1955). Economic growth and income inequality. *The American Economic Review*, 45(1), 1-28.

McKay, A. (2002). Defining and measuring inequality, Inequality Briefing: *Briefing No. 1*. Available at: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/3804.pdf

MoFED (2013). Development and Poverty in Ethiopia: 1995/96-2010/11. Technical report, Ministry of Finance and Economic Development, Ethiopia, Addis Ababa, Ethiopia.

MoFED (2015). The Second Growth and Transformation Plan (GTP II) (2015/16-2019/20). Technical report, Ministry of Finance and Economic Development, Ethiopia, Addis Ababa, Ethiopia.

Narayan K. (2004). Reformulating Critical Values for the Bounds F-statistics Approach to Co-integration: An Application to the Tourism Demand Model for Fiji", Discussion 02, Monash University, Victoria, Australia

OXFAM (2014). Working for the Few: Political Capture and Economic Inequality, OXFAM Briefing Paper, Oxford.

Pesaran, M. & Y. Shin (1999). An Autoregressive Distributed Lag Modeling Approach to Co-integration Analysis. In: Strom S. (Ed), Econometrics and Economic Theory in the 20th Century. Cambridge University Press: Cambridge.

Pesaran M.H., Y. Shin & R.J. Smith (2001). Bound Testing Approach to the Analysis of Level Relationships. *Journal of Applied econometrics*, 16: 289-326

Seid Y. T., A. Seyoum & S. N. Ali (2015). Ethiopia: An agrarian economy in transition, WIDER Working Paper, (2015/154), ISBN 978-92-9256-043-0, UNU-WIDER, Helsinki

Stock H. J. & W. Mark (1988). Variable Trends in economic time series. *The Journal of economic perspectives* 2(3): 147-174

Basu S. R. (2017). Do Data Show Divergence? Revisiting Global Income Inequality Trends. MPFD Working Paper WP/17/03. Bangkok:

Tassew W., J. Hoddinott & S. Dercon (2009). Poverty and Inequality in Ethiopia: 1995/96-2004/05, Addis Ababa University, International Food Policy Research Institute and University of Oxford, Addis Ababa, Ethiopia.

World Bank (2014). Africa's Pulse. The World Bank, Washington, DC

World Bank Group (2015). Ethiopia poverty assessment 2014. Technical report, The World Bank Group.

Wooldridge M. J. (2000). Introductory Economics: A modern Approach, Second Edition.

Zerayehu S. (2013). Economic Transformation and Sectoral Growth Options in Ethiopia: Considerations for Achieving Middle Income Country Status: University of Nairobi, Nairobi.