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# POVERTY AND ECONOMIC GROWTH IN ETHIOPIA: A MULTIVARIATE CAUSAL LINKAGE

Sheilla Nyasha[1], Yvonne Gwenhure and Nicholas M. Odhiambo

## Abstract

*This paper investigates the dynamic causal linkage between poverty reduction and economic growth in Ethiopia during the period from 1970 to 2014. To address the omission of variable bias, the study includes financial development and investment as intermittent variables – thereby creating a multivariate Granger-causality model. The study uses two proxies to measure the level of poverty in Ethiopia, namely: household consumption expenditure and infant mortality rate. Using the newly developed ARDL bounds testing approach to cointegration and the ECM-based causality model, the study finds that there is short-run bi-directional causality between economic growth and poverty reduction – irrespective of which variable is used as a proxy for poverty reduction. However, in the long run, the study finds unidirectional causality from economic growth to poverty reduction; but it fails to find any causal relationship between household consumption expenditure and economic growth. The study therefore concludes that while poverty reduction and economic growth are mutually beneficial in the short run; in the long run, it is economic growth that leads to poverty reduction when infant mortality rate is used as a proxy for poverty reduction.*

**Keywords:** Ethiopia, Poverty, Economic Growth, Granger-Causality

**JEL Classification Code:** I3, O11

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## 1. Introduction

The eradication of extreme poverty and hunger is the first, and probably the most important of the United Nations' Millennium Development Goals (MDGs). Although the target of halving the global extreme poverty rate by year 2015 has been met; globally, 836 million people are still living in extreme poverty (United Nations, 2015:4). The reality of poverty among the different societies has caused development economists to keep digging on what could alleviate poverty, leading to todays' vast growth-poverty nexus research.

The relationship between economic growth and poverty reduction has long been researched in numerous studies around the world; yet, the results are far from being conclusive. Although it is now widely recognised that economic growth is good for poverty reduction through the trickle-down effect (see Dollar and Kray, 2001; Adams, 2002; Bhanumurthy and Mitra, 2004; Lin, 2003; Arndt *et al*., 2006; among others), alternative views exist.

A number of studies have also shown that economic growth does not necessarily trickle down to the poor; but rather, it has a trickle-up effect (see Todaro, 1997). The proponents of the trickle-up effect argue that growth tends to increase inequalities; and it makes the rich better off than the poor. The resulting increase in inequality tends to increase poverty. The preceding two arguments have left some authors, such as Aghion and Bolton (1997), advancing the importance of redistribution policies, in order to permanently improve the efficiency of the economy.

In the growth-poverty causality literature, there are currently four conflicting views. The first view supports the notion that it is economic growth that causes poverty reduction; while the

second view strongly believes that it is the other way round. The third view postulates that economic growth and poverty reduction Granger-cause each other. Finally, the fourth view, although not unpopular, maintains that there is no causal relationship between economic growth and poverty reduction.

Although the growth-poverty nexus has been studied extensively of late, the majority of these studies have been concentrated in Asia and in selected African countries, leaving Ethiopia without much coverage. Where such studies on Ethiopia do exist, most of them have focused mainly on the impact of economic growth on poverty reduction, rather than on the causal relationship between the two.

Additionally, the majority of the previous studies on the causality between economic growth and poverty reduction have over-relied on a bivariate framework; although it is now known that the results of the bivariate causality test may be invalid, due to the omission of important variables affecting both economic growth and poverty (Odhiambo, 2009). Thus, the introduction of additional variables into the causality framework may not only alter the direction of causality; but it could also affect the magnitude of the estimates (see also Loizides and Vamvoukas, 2005; Odhiambo, 2009). Furthermore, the previous studies on economic growth and poverty have placed an overreliance on cross-sectional methods – even though it is now well-known that cross-sectional methods fail to satisfactorily address country-specific issues (see Casselli *et al*., 1996; Ghirmay, 2004).

Against this backdrop, the current study attempts to empirically examine the causal relationship between economic growth and poverty reduction in Ethiopia within a multivariate

Granger-causality setting, using the newly developed autoregressive distributed lag (ARDL) bounds testing approach. To the best of our knowledge, this might well be the first study to examine in detail the dynamic causal relationship between poverty reduction and economic growth in Ethiopia, using modern time-series techniques.

The rest of the paper is organised as follows: Section 2 provides an overview of the economic growth and poverty dynamics in Ethiopia. Section 3 reviews the literature on the growth-poverty nexus. Section 4 covers the estimation techniques and the empirical analysis; while Section 5 concludes the study.

## 2. Economic Growth and Poverty Dynamics in Ethiopia

According to the World Bank (2015), as of 2014 Ethiopia is sub-Saharan Africa's second most populous country, with a population of 96.5 million and a population growth rate of 2.5%. Its annual per capita income stands at $550, which is lower than the regional average gross national income. Over the last decade, the country has experienced strong, broad-based growth averaging 10.8% per year during the 2003/04 - 2012/13 period – compared to the regional average of 5.3%.

Although Ethiopia is among the top-ten African countries in terms of GDP (US$54.8 billion in 2014), its GDP growth trend has not been stable over the years. During the period from 1981 to 2014, the GDP growth rate reached a lowest of -11.10% in 1984 and reached a peak of 13.9% in 1986 (World Bank, 2015). Between 2004 and 2013, the GDP largely remained positive, averaging 11%. The post-2004 positive growth rate was mainly due to the focus on

heavy investment in infrastructure through the public sector led development strategy (Wondifraw *et al*., 2015).

A non-parametric and parametric analysis of spells of poverty and their persistence suggests that between 1994 and 1997, the incidence of absolute poverty in Ethiopia declined as a result of a period of peace and stability, as well as the reform and economic recovery that took place in the country.   The incidence then increased strongly in the years leading up to 2000, following a period of drought, war with Eritrea and political instability; but declined again in 2004 as the economy recovered (Bigsten and Shimeles (2008).

Despite the country's good growth performance over the past decade, the Global Multidimensional Poverty Index (MPI) ranked Ethiopia to be among the poorest developing countries in the world (see Oxford Poverty and Human Development Initiative, 2015). The MPI measures the incidence and intensity of poverty based on three main dimensions namely education, health and living standards disaggregated into ten weighted indicators. The ten indicators are  years of schooling, school attendance, child mortality, nutrition, electricity, sanitation, water, floor, cooking fuel and assets.

A comparative analysis of measures of poverty shows that 36.8% of the population lives on under US$1.25 per day whilst 72.2% lives on under US$2.00 per day. At a national level, the MPI fell from 0.68 in 2000 to 0.53 in 2011; whilst the incidence of poverty (headcount) fell from 93.6% to 85.2% over the same period. The multidimensional poverty in rural Ethiopia also decreased between 2000 and 2011 (see Oxford Poverty and Human Development Initiative, 2015: 7-8).  Figure 1 illustrates the changes in the MPI at national, urban and rural

level between the years 2000 and 2011; whilst Figure 2 shows the trends in GDP growth in Ethiopia and headcount poverty at US$1.90 *per* day and US$3.10 *per* day, for four specific years between 1995 and 2010.

**Figure 1: Changes in Multidimensional Poverty by Region and Over Time (2000-2011)**
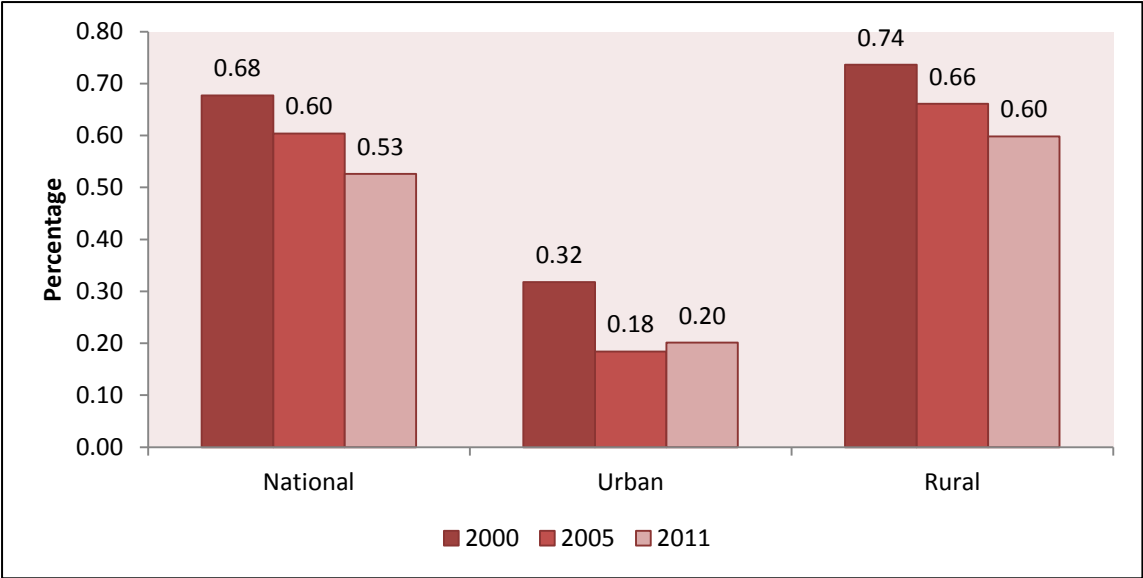


Source: *Oxford Poverty and Human Development Initiative. 2015. Ethiopia Country Briefing, Multidimensional Poverty Index Data Bank. University Of Oxford*

**Figure 2: Trends in Economic Growth and Poverty Headcount (1995-2010)**
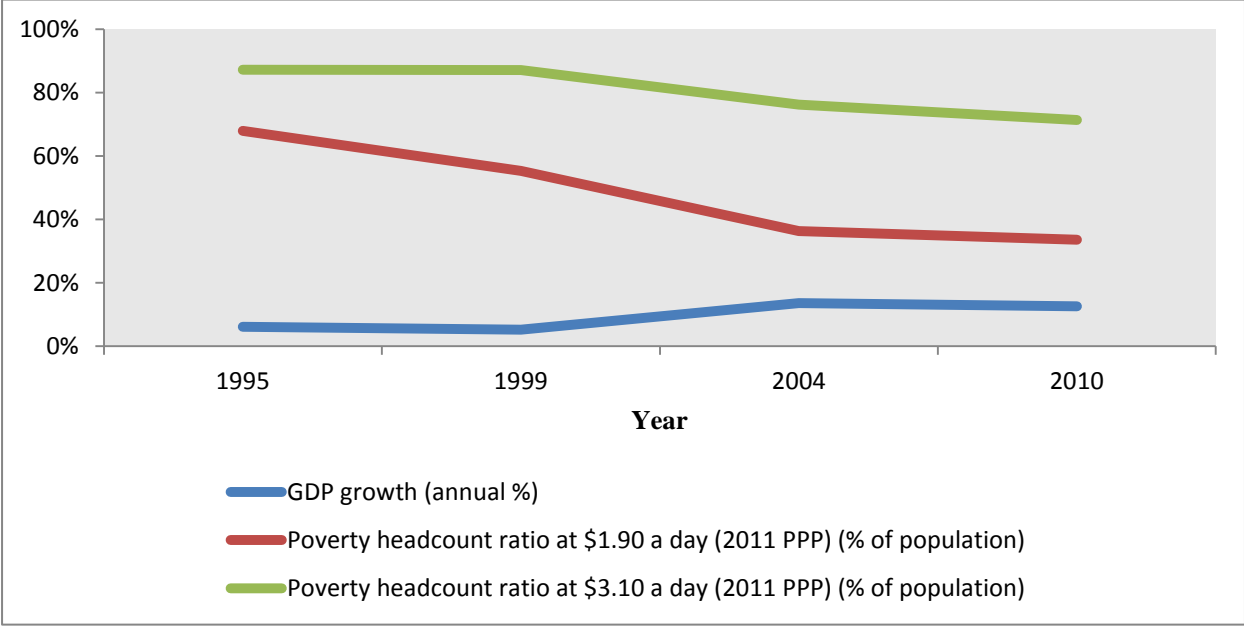


Source: World Bank (2016) - World Bank Development Indicators

## 3. Literature Review

The relationship between economic growth and poverty reduction has been examined extensively in the literature but yields contentious results. The theoretical literature consists mainly of two opposing views. The first supports that economic growth is essential for poverty reduction through a 'trickle-down effect' (Ohno, 2003). This view has been supported by various other studies by Dollar and Kray (2001); Ravillion and Chen (1997); World Bank (2005); Kray (2006); Adams (2004); Balisacan, *et.al.* (2003); and Owyong (2000) among others. The trickle-down effect is also supported by (Aghion, 1997), who advances that growth transmits to the poor through borrowing and lending in the capital market, since increased growth is accompanied by increased capital accumulation, which raises the funds available for the poor to borrow.

Contrary to the arguments in favour of the trickle-down effect of economic growth on poverty, the second view asserts that economic growth does not improve the lives of the very poor, but instead improves the circumstances of the middle to rich classes. This results in an increase in inequality and consequently leads to poverty (Todaro, 1997). This view is supported by studies such as Parel (2014), Basu and Mallick (2008), Fishlow (1995) and Dreza and Sen (1990) among others. Norton (2002), however, argues that the use of the word 'trickle down-effect' is a misnomer; growth actually entails a cascade, not a trickle since the study finds that growth in the incomes of the rich reduces the effects of poverty proportionally more than is the case for an increase in the incomes of the poor.

In the growth-poverty causality empirical literature, there are currently four conflicting views. The first view holds that a unidirectional causal relationship exists from economic growth to poverty reduction; the second view is the converse of the first; the third view postulates a bidirectional relationship between economic growth and poverty reduction; and the fourth sees no causal relationship between the two.

The unidirectional causal relationship running from economic growth to poverty reduction has been affirmed in studies that include Odhiambo (2009); Kar *et al.* (2011); Perez-Moreno and Weinhold (2012); Nuruddeen and Ibrahim (2014); and Aye (2013). Odhiambo (2009) used the recently developed ARDL bounds testing approach within a trivariate causality model to examine the causal relationship between financial development, economic growth and poverty reduction in South Africa for the period 1960 to 2006. The results revealed that both financial development and economic growth Granger-cause poverty reduction in South Africa in the long and short run. Kar *et al.* (2011) examined the causality between financial development,

economic growth and poverty in Turkey. Using the Vector Error Correction Model (VECM) Granger-causality approach, the results revealed that poverty reduction is Granger-caused by economic growth.

Perez-Moreno and Weinhold (2012) used a modified form of traditional Granger-causality tests for developing countries from 1970 to 1998 and found that economic growth causes poverty reduction. Nuruddeen and Ibrahim (2014) employed a bounds testing approach to cointegration and the Granger-causality test in the case of Nigeria from 2000 to 2012. The results were consistent with unidirectional causality from economic growth to poverty reduction. Aye (2013), also in the case of Nigeria, found short-run unidirectional causality from growth to poverty based on Johansen cointegration and a modified Hsiao-Granger-causality test within a Vector Autoregressive (VAR) and VECM framework.

Studies that have found poverty to have a causal effect on economic growth are, however, scant. Pradhan (2010) examined the nexus between finance, growth and poverty in India using cointegration and causality tests. The study confirmed the presence of unidirectional causality from poverty reduction to economic growth. Nindi and Odhiambo (2015) examined the causal relationship between poverty and economic growth in Swaziland for the period from 1980 to 2011. Using the ARDL bounds testing approach and the error correction model based on the Granger-causality method, they found a unidirectional causal flow from poverty reduction to economic growth. In the same spirit, Ellahi (2011) investigated the relationship between financial development, poverty reduction and economic growth in the case of Pakistan. Based on the ARDL bounds testing approach within the VECM Granger-causality framework, the results indicated that poverty reduction Granger-causes economic growth.

The third argument, that there is bidirectional causality between poverty reduction and economic growth, found support in the work of Lustig and Rigolini (2002). Their argument highlighted multiple complementarities between growth and poverty reduction. They further advanced that actions to reduce poverty can create virtuous cycles that raise economic growth, in turn reinforcing the reduction of poverty. Gries and Redlin (2010) also found negative bidirectional causality between growth and poverty, using general methods of moments techniques, based on an error correction model, in a panel of 114 developing countries and six regional subpanels from 1981 to 2005.

The fourth argument, that validates no causal relationship between economic growth and poverty reduction, has also been supported by empirical literature (see also Odhiambo, 2011; Perez-Moreno and Weinhold, 2012). Odhiambo (2011) examined the relationship between growth, employment and poverty in South Africa. Using the ARDL bounds test, the study found no causal relationship between economic growth and poverty reduction. Perez-Moreno and Weinhold (2012), after examining the causal relationship between economic growth and poverty reduction in developing countries between 1970 and 1998, found that in the 1980's to 1990's period, economic growth did not Granger-cause poverty reduction except in low income countries with a US$1/day poverty rate. Shahbaz and Rehman (2013) investigated the causal relationship between financial deepening, economic growth and poverty reduction using quarterly data for Pakistan over the period from 1972 to2011. Based on the ARDL bounds testing approach, no causality was found between economic growth and poverty reduction.

## 4. Estimation Technique and Empirical Analysis

### 4.1 Empirical Model Specifications

Bivariate causality test results are known to suffer from the omission of variable bias. According to Pradhan (2011), Odhiambo (2011), and Loizides and Vamvoukas (2005), it is possible that the causal link between two variables of interest could result from the omission of a vital variable in the causality model. In addressing the shortfalls associated with bivariate Granger-causality, this study employs a multivariate Granger-causality model within an autoregressive distributed lag (ARDL) bounds-testing framework to examine the causal relationship between poverty and economic growth in Ethiopia. This approach was originally proposed by Pesaran and Shin (1999) and later extended by Pesaran *et al.* (2001).

Financial development and investment are the intermittent variables in the multivariate model. The choice of financial development and investment as intermittent variables is based on their theoretical and empirical links with both economic growth and poverty.

Two proxies for poverty are used in this study − household consumption expenditure and infant mortality rate. The multivariate Granger-causality test is carried out using two models. Model 1 consists of economic growth, poverty 1 (household consumption expenditure), financial development, and investment [Y, POV1, FD, INV]; while Model 2 consists of economic growth, poverty 2 (infant mortality rate), financial development, and investment [Y, POV2, FD, INV].

A number of poverty proxies have been suggested due to a lack of time-series data on poverty in developing countries. These proxies include both income and headcount-based data for the

poor, and the Gini coefficient. Although some studies have used annual income per capita as a proxy for poverty, it has been found to be somewhat unreliable as it fails to account for other poverty dimensions (see also Odhiambo, 2011). To cater for this weakness, this study uses household consumption expenditure and infant mortality rate as proxies for poverty (see, among others, Quartey, 2005; Odhiambo, 2009; 2011).

The ARDL approach is deemed the ideal technique for this study because of the various advantages it has over other conventional estimation techniques (see, among others, Pesaran and Shin, 1999; Duasa, 2007; Odhiambo, 2008; Majid, 2008). Firstly, the ARDL procedure does not impose the restrictive assumption that all the study variables must be integrated of the same order. Thus, the ARDL approach can be applied to test the existence of a relationship between variables irrespective of whether the underlying regressors are integrated of order one [I(1)] or order zero [I(0)]. Secondly, it allows for inferences on long-run estimates, and it provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous. Thirdly, the ARDL technique considers a sufficient number of lags to capture the data-generating process in a general-to-specific modelling framework in order to obtain optimal lag length per variable. Fourthly, while conventional cointegration methods estimate the long-run relationship within a context of a system of equations, the ARDL procedure uses a single reduced-form equation. Fifthly, unlike other conventional cointegration techniques that are sensitive to the size of the sample, the ARDL bounds testing approach is suitable even when the sample size is small. Thus, the technique possesses superior small-sample properties. Hence, the approach is considered suitable for the analysis of the underlying relationship. In recent years, this approach has also been increasingly used in empirical research.

Before testing the causal relationship between poverty and economic growth, a cointegration test is carried out to establish whether the variables are cointegrated. In this study, the ARDL bounds testing approach to cointegration is used. The ARDL test for cointegration is conducted by taking each variable, in turn, as a dependent variable. Following Pesaran *et al.* (2001) and Odhiambo (2010), a system of cointegration equations associated with the multivariate Granger-causality models is expressed as follows:

*Error-Correction Based Cointegration Model*

**Model 1 - Economic growth and poverty as measured by household consumption expenditure**

$$\Delta lnY_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\Delta lnY_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\Delta lnPOV1_{t-i} + \sum_{i=0}^{n} \alpha_{3i}\Delta lnFD_{t-i} + \sum_{i=0}^{n} \alpha_{4i}lnINV_{t-i}$$

$$+ \alpha_5 lnY_{t-1} + \alpha_6 lnPOV1_{t-1} + \alpha_7 lnFD_{t-1} + \alpha_8 lnINV_{t-1} + \mu_{1t} \dots\dots\dots (1)$$

$$\Delta lnPOV1_t = \beta_0$$

$$+ \sum_{i=0}^{n} \beta_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \beta_{2i}\Delta lnPOV1_{t-i} + \sum_{i=0}^{n} \beta_{3i}\Delta lnFD_{t-i} + \sum_{i=0}^{n} \beta_{4i}lnINV_{t-i}$$

$$+ \beta_5 lnY_{t-1} + \beta_6 lnPOV1_{t-1} + \beta_7 lnFD_{t-1} + \beta_8 lnINV_{t-1} + \mu_{2t} \dots\dots\dots (2)$$

$$\Delta lnFD_t = \delta_0 + \sum_{i=0}^{n} \delta_{1i}\Delta lnY_{t-i} + \sum_{i=0}^{n} \delta_{2i}\Delta lnPOV1_{t-i} + \sum_{i=1}^{n} \delta_{3i}\Delta lnFD_{t-i} + \sum_{i=0}^{n} \delta_{4i}lnINV_{t-i}$$

$$+ \delta_5 lnY_{t-1} + \delta_6 lnPOV1_{t-1} + \delta_7 lnFD_{t-1} + \delta_8 lnINV_{t-1} + \mu_{3t} \dots\dots\dots (3)$$

$$\Delta lnINV_t = \theta_0 + \sum_{i=0}^{n} \theta_{1i}\Delta lnY_{t-i} + \sum_{i=0}^{n} \theta_{2i}\Delta lnPOV1_{t-i} + \sum_{i=0}^{n} \theta_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \theta_{4i}lnINV_{t-i}$$

$$+ \theta_5 lnY_{t-1} + \theta_6 lnPOV1_{t-1} + \theta_7 lnFD_{t-1} + \theta_8 lnINV_{t-1} + \mu_{4t} \dots \dots \dots (4)$$

**Model 2 - Economic growth and poverty as measured by infant mortality rate**

$$\Delta lnY_t = \emptyset_0 + \sum_{i=1}^{n} \emptyset_{1i}\Delta lnY_{t-i} + \sum_{i=0}^{n} \emptyset_{2i}\Delta lnPOV2_{t-i} + \sum_{i=0}^{n} \emptyset_{3i}\Delta lnFD_{t-i} + \sum_{i=0}^{n} \emptyset_{4i}lnINV_{t-i}$$

$$+ \emptyset_5 lnY_{t-1} + \emptyset_6 lnPOV2_{t-1} + \emptyset_7 lnFD_{t-1} + \emptyset_8 lnINV_{t-1} + \varepsilon_{1t} \dots \dots \dots (5)$$

$$\Delta lnPOV2_t = \vartheta_0 + \sum_{i=0}^{n} \vartheta_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \vartheta_{2i}\Delta lnPOV2_{t-i} + \sum_{i=0}^{n} \vartheta_{3i}\Delta lnFD_{t-i} + \sum_{i=0}^{n} \vartheta_{4i}lnINV_{t-i}$$

$$+ \vartheta_5 lnY_{t-1} + \vartheta_6 lnPOV2_{t-1} + \vartheta_7 lnFD_{t-1} + \vartheta_8 lnINV_{t-1} + \varepsilon_{2t} \dots \dots \dots (6)$$

$$\Delta lnFD_t = \rho_0 + \sum_{i=0}^{n} \rho_{1i}\Delta lnY_{t-i} + \sum_{i=0}^{n} \rho_{2i}\Delta lnPOV2_{t-i} + \sum_{i=1}^{n} \rho_{3i}\Delta lnFD_{t-i} + \sum_{i=0}^{n} \rho_{4i}lnINV_{t-i}$$

$$+ \rho_5 lnY_{t-1} + \rho_6 lnPOV2_{t-1} + \rho_7 lnFD_{t-1} + \rho_8 lnINV_{t-1} + \varepsilon_{3t} \dots \dots \dots (7)$$

$$\Delta lnINV_t = \gamma_0 + \sum_{i=0}^{n} \gamma_{1i}\Delta lnY_{t-i} + \sum_{i=0}^{n} \gamma_{2i}\Delta lnPOV2_{t-i} + \sum_{i=0}^{n} \gamma_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \gamma_{4i}lnINV_{t-i}$$

$$+ \gamma_5 lnY_{t-1} + \gamma_6 lnPOV2_{t-1} + \gamma_7 lnFD_{t-1} + \gamma_8 lnINV_{t-1} + \varepsilon_{4t} \dots \dots \dots (8)$$

Where:

**Y**    = real gross domestic product per capita (a proxy for economic growth)

**POV1** = household consumption expenditure (first proxy for poverty)

**POV2** = infant mortality rate per 1000 (second proxy for poverty)

**FD** = domestic credit extension to private sector by financial intermediaries (a proxy for bank-based financial development)

**INV** = share of gross fixed capital formation in GDP (a proxy for investment)

$a_0, \beta_0, \delta_0, \theta_0, \emptyset_0, \vartheta_0, \rho_0,$ and $\gamma_0$ = respective constants; $\alpha_1 - \alpha_8, \beta_1 - \beta_8, \delta_1 - \delta_8, \theta_1 - \theta_8, \emptyset_1 - \emptyset_8, \vartheta_1 - \vartheta_8, \rho_1 - \rho_8$ and $\gamma_1 - \gamma_8,$ = respective coefficients; $\Delta$ = difference operator; n = lag length; t = time period; $\mu_{it}$ *and* $\varepsilon_{it}$ = white-noise error terms; and *ln* = log linear transformation.

### *Error Correction Based Granger-Causality Model*

Following Narayan and Smyth (2008), Odhiambo (2011) and Hamdi *et al.* (2013), multivariate causality models for this study, based on an error-correction mechanism, are expressed as follows:

**Model 1 - Economic growth and poverty as measured by household consumption expenditure**

$$\Delta lnY_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \alpha_{2i}\Delta lnPOV1_{t-i} + \sum_{i=1}^{n} \alpha_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \alpha_{4i}lnINV_{t-i}$$

$$+ \alpha_5 ECM_{t-1} + \mu_{1t} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (9)$$

$$\Delta lnPOV1_t = \beta_0$$

$$+ \sum_{i=1}^{n} \beta_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \beta_{2i}\Delta lnPOV1_{t-i} + \sum_{i=1}^{n} \beta_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \beta_{4i}lnINV_{t-i}$$

$$+ \beta_5 ECM_{t-1} + \mu_{2t} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . (10)$$

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$$\Delta lnFD_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \delta_{2i}\Delta lnPOV1_{t-i} + \sum_{i=1}^{n} \delta_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \delta_{4i}lnINV_{t-i}$$

$$+ \delta_5 ECM_{t-1} + \mu_{3t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (11)$$

$$\Delta lnINV_t = \theta_0 + \sum_{i=1}^{n} \theta_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \theta_{2i}\Delta lnPOV1_{t-i} + \sum_{i=1}^{n} \theta_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \theta_{4i}lnINV_{t-i}$$

$$+ \theta_6 ECM_{t-1} + \mu_{4t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (12)$$

**Model 2 - Economic growth and poverty as measured by infant mortality rate**

$$\Delta lnY_t = \emptyset_0 + \sum_{i=1}^{n} \emptyset_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \emptyset_{2i}\Delta lnPOV2_{t-i} + \sum_{i=1}^{n} \emptyset_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \emptyset_{4i}lnINV_{t-i}$$

$$+ \emptyset_5 ECM_{t-1} + \varepsilon_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (13)$$

$$\Delta lnPOV2_t = \vartheta_0$$

$$+ \sum_{i=1}^{n} \vartheta_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \vartheta_{2i}\Delta lnPOV2_{t-i} + \sum_{i=1}^{n} \vartheta_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \vartheta_{4i}lnINV_{t-i}$$

$$+ \vartheta_5 ECM_{t-1} + \varepsilon_{2t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (14)$$

$$\Delta lnFD_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{n} \rho_{2i}\Delta lnPOV2_{t-i} + \sum_{i=1}^{n} \rho_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \rho_{4i}lnINV_{t-i}$$

$$+ \rho_5 ECM_{t-1} + \varepsilon_{3t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (15)$$

$$\Delta lnINV_t = \gamma_0 + \sum_{i=0}^{n} \gamma_{1i}\Delta lnY_{t-i} + \sum_{i=0}^{n} \gamma_{2i}\Delta lnPOV2_{t-i} + \sum_{i=0}^{n} \gamma_{3i}\Delta lnFD_{t-i} + \sum_{i=1}^{n} \gamma_{4i}lnINV_{t-i}$$

$$+ \gamma_5 ECM_{t-1} + \varepsilon_{4t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (16)$$

Where:

**Y** = real gross domestic product per capita (a proxy for economic growth)

**POV1** = household consumption expenditure per capita (first proxy for poverty)

**POV2** = infant mortality rate per 1000 (second proxy for poverty)

**FD** = domestic credit extension to private sector by financial intermediaries (a proxy for

bank-based financial development)

**INV** = share of gross fixed capital formation in GDP (a proxy for investment)

**ECM** = Error correction term

$a_0, \beta_0, \delta_0, \theta_0, \emptyset_0, \vartheta_0, \rho_0,$ and $\gamma_0$ = respective constants; $\alpha_1 - \alpha_5, \beta_1 - \beta_5, \delta_1 - \delta_5, \theta_1 - \theta_5, \emptyset_1 - \emptyset_5, \vartheta_1 - \vartheta_5, \rho_1 - \rho_5$ and $\gamma_1 - \gamma_5,$ = respective coefficients; $\Delta$ = difference operator; n = lag length; t = time period; $\mu_{it}$ *and* $\varepsilon_{it}$ = mutually uncorrelated white noise residuals; and *ln* = log linear transformation.

*Sources of Data*

This study utilised annual time-series data, covering the period from 1970 to 2014. The primary data sources for this study are the United Nations Conference on Trade and Development (UNCTAD) and the National Bank of Ethiopia. From the former, the following series from 1970 to 2014 were obtained: real gross domestic product per capita and real gross fixed capital formation. From the latter, M2 and household consumption expenditure were sourced. Infant mortality rate was sourced from the World Bank.

## 4.2 Empirical Analysis

*Unit Root Tests*

While the ARDL procedure does not require pre-testing the variable for stationarity tests, the tests provide guidance as to whether ARDL approach to data analysis is suitable or not, since the approach is only appropriate for the analysis of variables that are integrated of order not more than one [I(1)]. The variables are, therefore, first tested for stationarity, bbefore any analysis is done, using Dickey-Fuller generalised least square (DF-GLS) and Phillips-Perron (PP) unit-root tests. The results of the unit root tests for all the variables are presented in Table 1.

**Table 1: Stationarity Tests of all Variables**

| Panel 1: Dickey-Fuller generalised least square (DF-GLS) | | | | |
|---|---|---|---|---|
| **Variable** | **Stationarity of all Variables in Levels** | | **Stationarity of all Variables in First Difference** | |
| | Without Trend | With Trend | Without Trend | With Trend |
| lnY | 0.03 | -0.68 | -4.28*** | -4.96*** |
| lnPOV1 | 2.95 | -1.24 | -5.99*** | -6.82*** |
| lnPOV2 | -1.11 | -2.25 | -4.15*** | -4.79*** |
| lnFD | 1.49 | -0.06 | -3.98*** | -5.45*** |
| lnINV | 1.89 | -0.96 | -7.45*** | -8.33*** |
| **Panel 2: Phillips-Perron (PP)** | | | | |
| **Variable** | **Stationarity of all Variables in Levels** | | **Stationarity of all Variables in First Difference** | |
| | Without Trend | With Trend | Without Trend | With Trend |
| lnY | 1.00 | 0.59 | -4.23*** | -5.01*** |
| lnPOV1 | 2.50 | 0.07 | -6.23*** | -7.06*** |
| lnPOV2 | 0.70 | -0.87 | -4.31** | -4.18** |
| lnFD | 2.55 | 1.29 | -5.41*** | -5.78*** |
| lnINV | 2.00 | -0.40 | -7.37*** | -8.87*** |

Note: ** and *** denotes stationarity at 5% and 1% significance levels respectively

The results reported in Table 1, Panels 1 and 2, show that all the variables are consistently stationary in first difference. Hence, an ARDL approach to the analysis of data is appropriate.

What follows is the performance of a cointegration test to examine whether the variables in each model are cointegrated.

## *Cointegration Analysis*

Before testing for causality, it is of paramount importance to perform bounds F-test for cointegration to ascertain the possible existence of any long-run relationship between the variables of interest. The ARDL-based cointegration test is performed in two stages. In the first stage, the order of lags of the first differenced variables in equations (1-8) is determined. In order to establish the existence of any long-run relationship between the study variables, this stage is followed by the application of bounds F-test to equations (1-8). The null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration. The calculated F-statistic is matched with the critical values computed by Pesaran *et al*. (2001). If the calculated F-statistic is above the upper bound level, it can be concluded that the variables in question are cointegrated. Conversely, if it lies below the lower-bound level, it is concluded that the variables are not cointegrated. However, in the event that the calculated F-statistic falls within the upper and the lower bounds, the results are interpreted as inconclusive. The results of the bounds F-test for cointegration are reported in Table 2.

**Table 2: Bounds F-test for Cointegration**

| Model 1 – Household Consumption Expenditure (POV1), Financial Development (FD), Investment (INV) and Economic Growth (Y) | | | | Model 2 – Infant Mortality (POV2), Financial Development (FD), Investment (INV) and Economic Growth (Y) | | | |
|---|---|---|---|---|---|---|---|
| **Dependent Variable** | **Function** | **F-statistic** | **Cointegration Status** | **Dependent Variable** | **Function** | **F-statistic** | **Cointegration Status** |
| lnY | F(lnY\|lnPOV1, lnFD, lnINV) | 1.503 | Not cointegrated | lnY | F(lnY\|lnPOV2, lnFD, lnINV) | 1.954 | Not cointegrated |
| lnPOV1 | F(lnPOV1\| lnY, lnFD, lnINV) | 0.913 | Not cointegrated | lnPOV2 | F(lnPOV2\| lnY, lnFD, lnINV) | 4.760** | Cointegrated |
| lnFD | F(lnFD\| lnY, lnPOV1, lnINV) | 3.786* | Cointegrated | lnFD | F(lnFD\| lnY, lnPOV2, lnINV) | 3.976* | Cointegrated |
| lnINV | F(lnINV\| lnY, lnPOV1, lnFD) | 4.146* | Cointegrated | lnINV | F(lnINV\| lnY, lnPOV2, lnFD) | 1.893 | Not cointegrated |

| **Asymptotic Critical Values** | | | | | | |
|---|---|---|---|---|---|---|

| Pesaran *et al*. (2001), p.300 Table CI(iii) Case III | 1% | | 5% | | 10% | |
|---|---|---|---|---|---|---|
| | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| | 4.29 | 5.61 | 3.23 | 4.35 | 2.72 | 3.77 |

Note: * and ** denote statistical significance at 10% and 5% level respectively

The results of ECM-based cointegration tests between poverty reduction (POV1/POV2), economic growth (Y), financial development (FD), and investment (INV), as reported in Table 2, indicate the existence of a stable long-run relationship among the variables. Each model (Model 1 and Model 2) has two cointegrating vectors in which the F-statistic rejects the null hypothesis of no cointegration at 5% and 10% levels of significance.

Although the existence of cointegration between the variables suggests that there must be Granger-causality in at least one direction, it does not indicate the direction of causality (see also Odhiambo, 2009; Narayan and Smyth, 2004). The short-run causal impact is determined by the F-statistics on the explanatory variables, while the long-run causal impact is determined by the error-correction term. Although the error-correction term has been incorporated in all eight Granger-causality equations [equations (9) to (16)], only equations where the null hypothesis of no cointegration is rejected [equations (11), (12), (14) and (15)] will be estimated with an error-correction term (see Odhiambo, 2009; Narayan and Smyth, 2004).

There are, a priori, four possibilities regarding the causal relationship between poverty reduction, irrespective of proxy used, and economic growth. Firstly, there may be unidirectional causality from poverty reduction to economic growth; secondly, there may be unidirectional causality from economic growth to poverty reduction; thirdly, there may be bidirectional causality between poverty reduction and economic growth; and fourthly, there may be no causality at all between the two variables.

### ECM-Based Granger-Causality Results

Having found at least one cointegrating vector in both models, the next phase is to perform causality tests, incorporating the lagged error-correction term into the relevant regression equations. Causality is examined through the significance of the F-statistics of the explanatory variables as determined by the Wald Test or Variable Deletion Test, and the significance of the coefficient of the lagged error-correction term. The results of the causality test based on the Error-Correction Mechanism are reported in Table 3.

**Table 3: Results of Granger-Causality Tests**

| **Model 1** – Household Consumption Expenditure (POV1), Financial Development (FD), Investment (INV) and Economic Growth (Y) | | | | | **Model 2** – Infant Mortality (POV2), Financial Development (FD), Investment (INV) and Economic Growth (Y) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Dependent Variable** | **F-statistics [probability]** | | | | *ECT$_{t-1}$* [t-statistics] | **Dependent Variable** | **F-statistics [probability]** | | | | *ECT$_{t-1}$* [t-statistics] |
| | $\Delta lnY_t$ | $\Delta lnPOV1$ | $\Delta lnFD_t$ | $\Delta lnINV_t$ | | | $\Delta lnY_t$ | $\Delta lnPOV2$ | $\Delta lnFD_t$ | $\Delta lnINV_t$ | |
| $\Delta lnY_t$ | - | 7.644*** [0.000] | 3.278* [0.078] | 9.107*** [0.000] | - | $\Delta lnY_t$ | - | 4.729** [0.036] | 0.111 [0.741] | 6.264** [0.017] | - |
| $\Delta lnPOV1$ | 7.278*** [0.000] | - | 0.794 [0.379] | 4.249** [0.046] | - | $\Delta lnPOV2$ | 3.997* [0.060] | - | 1.077 [0.306] | 0.300 [0.587] | -0.201*** [-3.117] |
| $\Delta lnFD_t$ | 1.698 [0.204] | 3.619* [0.073] | - | 3.834* [0.070] | -0.038*** [-4.277] | $\Delta lnFD_t$ | 3.775* [0.643] | 0.002 [0.967] | - | 0.006 [0.937] | -0.109*** [ -4.366] |
| $\Delta lnINV_t$ | 8.324*** [0.000] | 7.818*** [0.001] | 2.477 [0.124] | - | -0.228*** [-3.179] | $\Delta lnINV_t$ | 2.473 [0.124] | 3.340* [0.075] | 0.541 [0.466] | - | - |

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively

The empirical results reported in Table 3, Model 1, for poverty, as measured by household consumption expenditure (POV1), financial development (FD), investment (INV), and economic growth (Y) reveal that in Ethiopia, economic growth and poverty reduction Granger-cause each other. However, this applies only in the short-run, as confirmed by F-statistics of $\Delta lnPOV1$ in the economic growth function and that of $\Delta lnY$ in the poverty function, which are both statistically significant. In the long run, no causality was found.

Other results reported in Model 1 reveal that in Ethiopia: (i) there is distinct short-run and long-run unidirectional causality from poverty reduction to financial development; (ii) there is distinct short-run and long-run unidirectional causality from investment to financial development; (iii) there is short-run unidirectional causality from financial development to economic growth; (iv) there is short-run bidirectional Granger-causality between economic growth and investment; but in the long run, causality is unidirectional, flowing from economic growth to investment; (v) there is short-run bidirectional causality between poverty reduction and investment; but in the long run, there is unidirectional causality from poverty reduction to investment; and (vi) there is no causality between savings and economic growth.

The empirical results reported in Table 3, Model 2, for poverty, as measured by infant mortality rate (POV2), financial development (FD), investment (INV), and economic growth (Y) show that in Ethiopia, economic growth and poverty reduction Granger-cause each other in the short run. This is confirmed by F-statistics of $\Delta lnPOV2$ in the economic growth function and that of $\Delta lnY$ in the poverty function, which are both statistically significant. However, in the long run, the results reveal the existence of unidirectional causality from economic growth to poverty reduction. This finding is confirmed by the error correction term

lagged one period ($ECM_{t-1}$) in the poverty function that is negative and statistically significant.

Other results reported in Model 2 reveal that in Ethiopia: (i) there is distinct short-run and long-run unidirectional Granger-causality from economic growth to financial development; (ii) there is short-run unidirectional causality from investment to economic growth, but there is no causality between the two in the long run; (iii) there is short-run unidirectional causality from poverty reduction to investment, but there is no causality between the two in the long run; (iv) there is no causality between poverty reduction and financial development, both in the short run and in the long run; and (v) there is no causality between financial development and investment, both in the short run and in the long run.

Overall, the empirical results reported in Tables 3 for both models (Models 1 and 2) imply that in Ethiopia, poverty reduction, irrespective of the proxy, and economic growth drive each other, but only in the short run. However, in the long run, it is economic growth that propels poverty reduction, as proxied by infant mortality rate. A summary of these results is presented in Table 4.

**Table 4: Summary of Results**

| Model 1 (POV1 & Y) | | Model 2 (POV2 & Y) | |
|---|---|---|---|
| Direction of Causality | | Direction of Causality | |
| Short Run | Long Run | Short Run | Long Run |
| Y → POV1 | No causality | Y → POV2 | Y → POV2 |
| POV1 → Y | No causality | POV2 → Y | No causality |

Notes: Y=economic growth; POV1=poverty as measured by household consumption expenditure; POV2=poverty as measured by infant mortality rate

The results of this study are consistent with results of similar earlier work. The results provide evidence in support of bidirectional causality between poverty reduction and economic growth in the short run (see also Lustig and Rigolini, 2002; Gries and Redlin, 2010). However, in the long run, evidence is split between that which is largely consistent with the neutrality view, and that which is consistent with growth-led poverty reduction. For growth-led poverty reduction, see Odhiambo (2009), Kar et al (2011), Nuruddeen and Ibrahim (2014), and Aye (2013) among others. For the neutrality view, see Odhiambo (2011), and Shahbaz and Rehman (2013), among others.

On the policy implication front, in the short run, it is recommended that policy makers consider both growth-enhancing and poverty-reduction policies since economic growth and poverty reduction have been shown to mutually drive each other. However, in the long run, policies that target economic growth are recommended. Policy makers should also consider which poverty reduction indicators to target as they embark on the long-run policy drive since poverty-reduction response to long-run economic growth depends on the proxy of poverty targeted.

## 5.  Conclusion

In this paper, we have explored the dynamic causal linkage between poverty-reduction and economic growth in Ethiopia during the period from 1970 to 2014. The study was motivated by the dynamics of economic growth and poverty in Ethiopia. Despite the country's remarkable growth performance over the past decade, and being among the top-ten biggest economies in sub-Saharan Africa in terms of GDP, Ethiopia still remains one of the world's poorest countries; with a *per capita* income of $550, which is substantially lower than the

regional average. Unlike some of the previous studies on this subject, we have used the newly developed ARDL bounds testing approach to cointegration and the ECM-based causality model to examine this linkage. We have also included two intermittent variables, namely: financial development and investment, in order to address the omission-of-variable bias in our causality model. In addition, we have used two proxies to measure the level of poverty in Ethiopia, namely: household consumption expenditure and the infant mortality rate. Our results show that there is short-run bi-directional causality between poverty reduction and economic growth – irrespective of which variable is used as a proxy for poverty reduction. However, in the long run, the study finds a unidirectional causal flow from infant mortality to economic growth; but it fails to find any causal relationship between household consumption expenditure and economic growth. The study, therefore, concludes that while poverty reduction and economic growth in Ethiopia are mutually beneficial in the short run; in the long run, it is economic growth that leads to poverty reduction when infant mortality rate is used as a proxy for poverty reduction.

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