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The Impact of Human Capital Development on Economic Growth in Ethiopia: *Evidence from ARDL Approach to Co-Integration*

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Abstract

The main objective of the study is to investigate the long run and short run impact of human capital on economic growth in Ethiopia (using real GDP per capita, as a proxy for economic growth) over the period 75-2011. The ARDL Approach to Co-integration and Error Correction Model are applied in order to investigate the long-run and short run impact of Human capital on Economic growth. The finding of the Bounds test shows that there is a stable long run relationship between real GDP per capita, education human capital, health human capital, labor force, gross capital formation, government expenditure and official development assistance. The estimated long run model revels that human capital in the form of health (proxied by the ratio of public expenditure on health to real GDP) is the main contributor to real GDP per capita rise followed by education human capital (proxied by secondary school enrolment). Such findings are consistent with the endogenous growth theories which argue that an improvement in human capital (skilled and healthy workers) improves productivity. In the short run, the coefficient of error correction term is -0.7366 suggesting about 73.66 percent annual adjustment towards long run equilibrium. This is another proof for the existence of a stable long run relationship among the variables. The estimated coefficients of the short-run model indicate that education is the main contributor to real GDP per capita change followed by gross capital formation (one period lagged value) and government expenditure (one period lagged value). But, unlike its long run significant impact, health has no significant short run impact on the economy. Even its one period lag has a significant negative impact on the economy. The above results have an important policy implication. The findings of this paper imply that economic performance can be improved significantly when the ratio of public expenditure on health services to GDP increases and when secondary school enrolment improves. Such improvements have a large impact on human productivity which leads to improved national output per capita. Hence policy makers and / or the government should strive to create institutional capacity that increase school enrolment and improved basic health service by strengthening the infrastructure of educational and health institutions that produce quality manpower. In addition to its effort, the government should continue its leadership role in creating enabling environment that encourage better investment in human capital (education and health) by the private sector.

***Key Words**: Ethiopia, Economic Growth, Human capital, Education, Health, ARDL method of Co-integration, ECM model.*

1. **INTRODUCTION:** With its large reserves of human and natural resources, Ethiopia should have been a prosperous economy. However, it is one of the poorest countries in the world manifested by low per capita income and low human development index. According to Word Bank (2011) data, the real per capita income level of the country was 141.86 USD in 1981.This figure has decreased with some fluctuations for the next 11 years and reached to 115.8 USD in 1991. After the overthrow of the military regime, real per capita income level showed a continuous improvement for the next 5 years and reached to 125.58 USD in 1996/97. But, in the next 6 years generally declined (with some ups and downs) to 124.30 USD in 2003 .Starting from 2004, it has increased continuously and reached to 231 USD in 2011. On the other hand, in 2000, human development index of the country was 0.274. This figure has slightly increased to 0.363 in 2011 (UNDP, 2011).

Modern theory of economic growth argues that human capital, especially education and health has the principal role on achieving economic growth and development (Gyimah-Brempong and Wilson, 2005). In line with this, Ethiopia has made some movements to create skilled and competent citizens through designing different education and health policies and implementing them. Though the degree of emphasis and success may vary from one regime to another, Ethiopia has devoted much resource and efforts to the education and health sectors anticipating productivity improvement of the citizens and thereby economic growth. These resources are cost to the society not only because they are economic resources but also because they have alternative uses. Therefore, investigating the relationship between human capital (resources devoted to this sector) and economic growth may be a big concern to policy makers. As a result, the main objective of the study is to analyze the impact of human capital development on economic growth in Ethiopia over the period 1974/75-2010/11. In line with this general objective, the study will try to answer the following research questions:

1. Does human capital development have a significant long-run and short-run impact on economic growth in Ethiopia?
2. Is there a causal relationship between human capital development and economic growth in Ethiopia?

Some researchers have tried to investigate the relationship between human capital development and economic growth in Ethiopia. For instance, using school enrollment as a proxy for human capital, Seid (2000) found an insignificant impact of human capital on output level. Similarly Wubet (2006) has got the same result that proves the non-existence of any relationship between the two macroeconomic variables. But, their approach of measuring human capital ignores the health aspect of human capital development, while both education and health are important component of human capital. On the other hand, using public spending on education and health sector as a proxy for investment in human capital development, Teshome (2006) found a positive impact of human capital development on economic growth in Ethiopia. This finding is reinforced by Tofik (2012) who found a positive and significant relationship between capital spending on human capital and economic growth. But both of them didn't show the separate impact of the health and education sector on economic growth. In addition Tofik failed to incorporate the recurrent human capital expenditure account of the government. Since both education and health are important elements of human capital, using both indicators is relatively better measure of human capital than using education or health indicators alone. Therefore, the author of this paper has used both the education and health indicators so as to empirically analyze the effects of human capital development on economic growth by taking secondary school enrolment rate as a proxy for human capital in the education area and the ratio of public expenditure on health to GDP as a proxy for human capital in the health area.

All of the above researchers who tried to identify the relationship between human capital and economic growth in Ethiopia have used the same technique of analysis (Johnson's Co-integration technique). Even though the Johnson's Co-integration technique is one of the widely used methods of time series analysis, its outcome could not be reliable for small sample size (Pesaran and Shin, 1997; Narayan, 2005; Udoh and Ogbuag, 2012). Relatively, the Autoregressive distributed lag method of co-integration has more advantage over the Johnsons method (Pesaran and Shin, 1997; Pesaran and Shin, 1999; Pesaran, Shin, and Smith, 2001; Harris and Sollis, 2003; Narayan, 2005; Chaudhry & Chaudhry, 2006; Ang ,2007 and Rahimi and Shahabadi , 2011). Hence this paper has used the ARDL approach to provide valid empirical evidence on the effects of human capital development on economic growth.

2. **Empirical Literature:** Despite their conclusions are controversial, different scholars has tried to analyze the relationship between human capital and economic growth. Mankiw, Romer, and Weil (1992), on their cross-country regression analysis, have showed that human capital as one of the reasons for income variation across countries. That means they found a positive and significant correlation between human capital and per capita income growth. Barro (1991) also found the same result on 98 countries during the period from 1960 to 1985. In their OLS based human capital augmented Cob-Douglass Production function analysis, enrollment rates to primary and secondary school are taken as a proxy of the human capital.

Again, Barro (1996; 2013) have measured human capital using average years of schooling in primary and secondary school .He found positive and significant relationship between per capita income growth and human capital from 1960 to 1990. Based on his simple panel regression analysis, Barro reported that the process of catching up was firmly linked to human capital formation: only those poor countries with high levels of human capital formation relative to their real GDP tended to catch up with the richer countries. Benhabib and Spiegel (2002) also find an indirect positive and significant correlation between the two macroeconomic variables. According to their finding, countries with a larger human capital stock show faster technological catch-up. Similarly, Bassanini and Scarpetta (2001) investigate the relationship between human capital accumulation and economic growth for OECD countries between 1971 and 1998. They said that one extra year of schooling increases the long-run average per capita output level by about 6%.

Barro and Sala-i-Martin (1995; 2004) also tried to prove the effect of primary, secondary, and tertiary school attainment (by sex) on economic growth. They got an insignificant effect of primary education of males and females on economic growth. But they found significant relationship for males' secondary and tertiary education. They also analyzed the role of educational attainment on the convergence theory. Their result proves that countries with relatively low initial GDP grow faster when they have higher levels of human capital in the form of educational attainment .Baldwin and Borrelli (2008) also wrote an article that show relationship between higher education and economic growth in US and conclude that expenditure on higher education has a positive relation with per capita income growth.

Some scholars like, Barro (1966; 2013) has formulated a model that includes physical capital inputs, level of education, health capital, and the quantity of hours worked. The model assumes that "people are born with initial endowments of health which depreciate with age and grow with investment in health". Based on his analysis, he concluded that an increase in health indicators raises the incentives to invest in education and a raise in health capital lowers the rate of depreciation of health. Taking life expectancy as an indicator of health, Bloom Canning, and Sevilla (2004) also found a strong positive and statistically significant effect on output. They suggest that each extra year of life expectancy raises the productivity of workers and leads to an increase of 4% in output.

Gyimah- Brempong and Wilson (2005) and Odior (2011) also argued that education captures just one aspect of human capital. It could not account the differences in school quality and health aspect of human capital. For instance, based on microeconomic evidences, Strauss and Thomas (1998) argue that health explains the variations in wages at least as much as education. Gyimah-Brempong and Wilson (2005) find that health capital indicators positively influence aggregate output. They find that about 22 to 30 percent of the growth rate is attributed to health capital, and improvements in health conditions equivalent to one more year of life expectancy are associated with higher GDP growth of up to 4 percentage points per year. Barro and Sala-i-Martin (1995; 2004), have also included life expectancy and infant mortality in their growth regressions as a proxy of tangible human capital and concluded that life expectancy has a strong positive relation with growth.

Using other indicators of human capital, some researchers have analyzed the relationship between the two macroeconomic variables. For instance, using the dynamic panel estimator method, Gyimah- Brempong and Wilson (2005) showed a positive and robust link between investment in health & education and economic growth in Africa and the rest of the world for the period 1960-2000. Odior (2011), also made a research in Nigeria to provide an empirical evidence on whether government expenditure on health can lead to economic growth or not. He used an integrated sequential dynamic computable general equilibrium (CGE) model and found a significant relationship between economic growth and government expenditure on health sector. In addition, taking government recurrent and capital expenditures on education and health, Oluwatobi & Ogunrinola (2011) and Umaru (2011) have made an econometric analysis in Nigeria , over the period 1970-2008 and 1977- 2007 respectively, to analyze the relationship between government spending on education and health and economic growth. They followed the Johnson cointegration technique and got a positive relationship between government recurrent expenditure on human capital development and real output, while capital expenditure is negatively related to the level of real output. Kefela and Rena (2007) who made their study on North East African States also showed that 40 percent to 60 percent of growth rates in per capita GDP were resulted from investment in human capital.

When we come to the Ethiopian case, Woubet (2006) has made co-integration analysis to investigate the impact of human capital on total level of output using the Barro and lee method of human capital measurement over the period 1971-2005. He got an insignificant relationship between the two macroeconomic variables. But this finding ignores health which is one component of human capital development. For instance, the returns to health in rural Ethiopian agriculture are more than double of the returns to inputs like fertilizer (Kefela and Rena, 2007).On the other hand, using public spending on education and health sector as a proxy for investment in human capital development, Teshome (2006) found a positive impact of human capital development on economic growth in Ethiopia over the period 1960/61-2003/04. This finding is reinforced by Tofik (2012) who found a positive and significant relationship between capital spending on human capital and economic growth from year 1975 to year 2010. But both of them didn't show the separate impact of the health and education sector's spending on economic growth. In addition Tofik fails to incorporate the recurrent expenditure account of the government.

Generally, the empirical analyses related to human capital and economic growth mostly rely on measures of formal education as a proxy for human capital formation by ignoring the contribution of health on human capital development, while both education and health are important for human capital development (Gundlach, 1996; Karagiannis & Benos (2009)).

To avoid such limitations, many researchers have used both of the education and health measures as a proxy for human capital. For instance, Karagiannis & Benos (2009) have used enrolment rates, student/teacher ratios for the educational indicators and number of medical doctors and hospital beds for the health indicators. On the other hand, Qadri and Waheed 2011) have used education indicator (enrolment rates) and health indicator (share of total government expenditure on health to GDP). Barro (2003) has also measured human capital using education (educational attainment) and health (life expectancy). Including both the education and health indicators are relatively better measure of human capital than using education or health indicators alone. Because it expresses the notion that both education and health are an important elements of human capital.

With regard to this paper, both the education and health indicators separately are used so as to empirically analyze the effects of human capital development on economic growth. The secondary school enrolment rate level is used as a proxy for human capital in the education area. On the other hand, the share of total government expenditure on health to GDP is used as a proxy for health human capital in the health area. The availability of data in Ethiopia and other international databases related to education and health indicators of Ethiopia are also more suitable to use such techniques of measurement than the other alternative measures discussed above.

3. Method of estimation and Data description:

3.1 The Model: Different scholars have designed different conceptual frameworks that incorporate human capital as one of the determinant factor of economic growth. Among those scholars, Mankiw, Romer and Weil (1992) and Weil (2009) has accommodated human capital as an independent factor of production in their empirical analysis. Griffin and Knight (1990) as cited by Appleton and Teal (1998) has also used health and education as determinants of GDP per capita assuming education, good health and longevity are essentially valuable output determinants. These researchers have employed the human capital augmented Solow growth model (Cobb- Douglas production function) as their framework, specifying output/output per worker as dependent variable while labor, physical capital and human capital are dependent variables.

Bernanke and Gurkanak (2001) also applied Cobb- Douglas production function so as to analyze the relationship between human capital and economic growth. Duma (2007) who studied the sources of growth in Sri Lanka has used a human capital augmented Cobb-Douglas production function in the study, taking output growth as a dependent variable while growth in labor, growth in physical capital and growth in human capital were taken as explanatory variable. Madsen, Saxena , and Ang (2008) who studied the relationship between human capital and economic growth of India have also used the human capital augmented production function and employed the co-integration method was adopted for their estimation.

The general form of the human capital augmented Cobb-Douglas production is shown below:

$$Y_t = K_t^{\alpha} H_t^{\beta} (AL)_t^{1-\alpha-\beta} u \quad \ldots\ldots(1)$$

Where,

Y is output level; α is Elasticity of Physical capital with respect to output

K is level of physical capital β is Elasticity of Human capital with respect to output

H is level of Human Capital u is an error term

L is the level labor force, $\alpha + \beta < 1$

A is level of Productivity/technology

Therefore, based on this theoretical framework developed by Mankiw, Romer and Weil (1992), the following empirically estimable log-linear type of model (with some modification to accommodate other additional variables) is specified.

$$LnGDPPC_t = f(LnLAB_t, LnGCF_t, LnEHC_t, LnHHC_t, LnGOEX_t, LnODA_t, D_1, D_2) \ldots\ldots(4)$$

Where:

$LnGDPPC_t$ = Natural logarithm of real GDP per capita at time *t*.

$LnLAB_t$ = Natural logarithm of labor force growth rate at time *t*.

$LnGCF_t$ = Natural logarithm of gross capital formation at time *t*.

$LnEHC_t$ = Natural logarithm of education human capital at time *t*.
$LnHHC_t$ = Natural logarithm of health human capital at time *t*.
$LnGOEX_t$ = Natural logarithm of total government expenditure at time *t*
$LnODA_t$ = Natural logarithm of official development assistance at time *t*.
D_1 and D_2 are dummy variables for policy change and recurrent drought

3.2 Method of analysis: In this study, the Autoregressive Distributed Lag (ARDL) approach to cointegration , which is proposed by Pesaran and Shin (1997, 1999) and Pesaran, Shin, and Smith (2001), is used to determine/test the long-run co-integration relationships between variables. Because this approach have a lot of advantages over the Johansen maximum Likelihood (1988) cointegration method. First , the ARDL approach can be applied irrespective of whether the regressors are I(1) and I(0). Second, while the Johansen cointegration techniques require large data samples for validity, the ARDL procedure provides statistically significant result in small samples (Pesaran and Shin, 1997; Pesaran and Shin, 1999; Narayan, P., 2005; Udoh and Ogbuag , 2012). That means, it avoids the problem of biasness that arise from small sample size (Chaudhry & Chaudhry, 2006).Third, the ARDL procedure provides unbiased and valid estimates of the long run model even when some of the regressors are endogenous (Harris and Sollis, 2003, Pesaran and Shin, 1999, Ang,J.,2009). Further, in using the ARDL Approach, a dummy variable can be included in the co-integration test process, which is not permitted in Johansen's method (Rahimi and Shahabadi, 2011). Therefore, the following ARDL model is specified.

$$\begin{aligned}\Delta LnGDPPC_t &= \beta_o + \lambda_1 LnGDPPC_{t-1} + \lambda_2 LnLAB_{t-1} + \lambda_3 LnGCF_{t-1} \\ &+ \lambda_4 LnEHC_{t-1} + \lambda_5 LnHHC_{t-1} + \lambda_6 LnGOEX_{t-1} + \lambda_7 LnODA_{t-1} \\ &+ \beta_1 \sum_{i=1}^{n} \Delta LnGDPPC_{t-i} + \beta_2 \sum_{i=0}^{n} \Delta LnLAB_{t-i} + \beta_3 \sum_{i=0}^{n} \Delta LnGCF_{t-i} \\ &+ \beta_4 \sum_{i=0}^{n} \Delta LnEHC_{t-i} + \beta_5 \sum_{i=0}^{n} \Delta LnHHC_{t-i} + \beta_6 \sum_{i=0}^{n} \Delta LnGOEX_{t-i} \\ &+ \beta_7 \sum_{i=0}^{n} \Delta LnODA_{t-i} + \beta_8 t + \beta_9 D_1 + \beta_{10} D_2 + e_t \quad \ldots\ldots\ldots\ldots (22)\end{aligned}$$

Where:
$LnGDPPC_t$ = Natural logarithm of real GDP per capita at time *t*.
$LnLAB_t$ = Natural logarithm of labor force growth rate at time *t*.
$LnGCF_t$ = Natural logarithm of gross capital formation at time *t*.
$LnEHC_t$ = Natural logarithm of education human capital at time *t*.
$LnHHC_t$ = Natural logarithm of health human capital at time *t*.
$LnGOEX_t$ = Natural logarithm of total government expenditure at time *t*
$LnODA_t$ = Natural logarithm of official development assistance at time *t*.
D_1 and D_2 are dummy variables for policy change and recurrent drought
λ_1 , λ_2, λ_3, λ_4, λ_5 , λ_6, and λ_7 are coefficients that measure long run relationships.
β_1 , β_2, β_3, β_4, β_5 , β_6, and β_7 are coefficients that measure short run relationships.
e_t is an error term and n denotes lag length of the auto regressive process.
t is the time trend of the model.

To test whether there is a long run equilibrium relationship between the variables; **bounds test for co-integration** is carried out as proposed by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (2001). The hypotheses are shown below:

H_o: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = \lambda_7 = 0$. That means there is no long run relationship among the variables.

H_a: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq \lambda_7 \neq 0$. That means there is a long run relationship among the variables.

In this paper, the computed F-statistics is compared with both critical values provided by Pesaran, Shin, and Smith (2001) and Narayan (2005.

After confirming the existence of long-run relationship among the variables, the following stable long-run model is estimated:

$$LnGDPPC_t = \beta_0 + \beta_1 \sum_{i=1}^{n} LnGDPPC_{t-i} + \beta_2 \sum_{i=0}^{n} LnLAB_{t-i}$$

$$+\beta_3 \sum_{i=0}^{n} LnGCF_{t-i} + \beta_4 \sum_{i=0}^{n} LnEHC_{t-i} + \beta_5 \sum_{i=0}^{n} LnHHC_{t-i}$$

$$+ \beta_6 \sum_{i=0}^{n} LnGOEX_{t-i} + \beta_7 \sum_{i=0}^{n} LnODA_{t-i} + \beta_8 t + \beta_9 D_1 + \beta_{10} D_2 + v_t \ldots\ldots(23)$$

The next step is to estimate the vector error correction model that indicates the short run dynamic parameters (adjustment parameters that measure the speed of correction to long-run equilibrium after a short-run disturbance). The standard ECM is estimated as follows:

$$\Delta LnGDPPC_t = \beta_o + \beta_1 \sum_{i=1}^{a} \Delta LnGDPPC_{t-i} + \beta_2 \sum_{i=0}^{b} \Delta LnLAB_{t-i}$$

$$+\beta_3 \sum_{i=0}^{c} \Delta LnGCF_{t-i} + \beta_4 \sum_{i=0}^{d} \Delta LnEHC_{t-i} + \beta_5 \sum_{i=0}^{e} \Delta LnHHC_{t-i}$$

$$+\beta_6 \sum_{i=0}^{f} \Delta LnGOEX_{t-i} + \beta_7 \sum_{i=0}^{g} \Delta LnODA_{t-i} + \beta_8 t + \beta_9 D_1$$

$$+\beta_{10} D_2 + \delta\, ECT_{t-1} + u_t \ldots\ldots(24)$$

Where:

β_1, β_2, β_3, β_4, β_5, β_6, and β_7 = coefficients that represents the short run dynamics of the model .

ECT_{t-1} = error correction term lagged by one period.

u_t = vector of white noise error terms and $(a - g)$ denotes the optimal lag length of each variable in the auto regressive process.

D_1 and D_2 are dummy variables for policy change and recurrent drought

δ = error correction parameter that measure the speed of adjustment towards the long run equilibrium.

The error correction term term (ECT) is derived from the corresponding long run model whose coefficients are obtained by normalizing the equation. After estimating the long run and short run model, misspecification test, normality test, serial correlation test, heteroscedasticity test and cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) test for stability of the model is undertaken to check the robustness of the model. In order to estimate the models specified in equation (22), (23) and (24) above and to perform the pre estimation and post estimation diagnostic tests, *Microfit4.1* and *Eviews6* statistical packages are used.

3.3 Data Sources and description: The study has used 37 year annual data from 1975-2011. Most of the data is collected from Ministry of Finance and Economic Development (MOFED), Ethiopian Economic Association (EEA) and National Bank of Ethiopia (NBE). Some of the data is also collected from international organizations (such as, UNCTAD and World Bank CD–ROM). The detailed sources of data for each variable are described in table 2. The descriptions and measurements of the dependent and the explanatory variables that are included in the model of this paper are explained as follows:

i. Real GDP Per Capita (GDPPCt)

Like the studies made by Mankiw , Romer and Weil (1992), Barro and Lee (1993), Benhabib and Spiegel (1994) and Barro and Sala-i-Martin (1995; 2004), Real GDP per capita that indicate the total amount of the market value of all domestically produced final goods and services divided by total population is taken as a proxy for economic growth (dependent variable).

ii. Share of Real Gross Capital Formation to GDP (GCF_t)

It is a proxy for physical capital stock in the economy and it is derived by dividing the gross fixed capital formation adjusted through GDP deflator to real GDP. Barro and Sala-I-Martin (1995; 2004) shows that the sign expected from the coefficient GCF is positive, because the accumulation of the capital is supposed to favor the growth of the real GDP by fostering further production of new goods and services.

iii. Labor

Theoretically, labor force is a major element for sustainable rate of economic expansion. It could be the engine of growth for labor intensive economies like Ethiopia. But if it couldn't be used efficiently and if it is less productive, it may be a burden for the economy because of high rate of unemployment. It is incorporated in the model in its growth rate.

iv. Human Capital Development

Human capital is a factor influencing labour productivity because it facilitates the absorption of new technology, increases the rate of innovativeness and promotes efficient management (Adamu, 2003; as cited in Sankay, Ismail, and Shaari, 2010). Consequently, for high labor productivity, investment in human capital is termed as endogenous factor that enhance accumulation of physical capital through knowledge, skills, attitudes and health status of the people who participate in the economic process. Therefore, this variable is included in the model to represent the "knowledge, skills, competence and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being. It is represented by the share of public health expenditure (recurrent and capital) to GDP and secondary school enrolment. Therefore, higher level of human capital development in the form of education and health are expected to have a positive impact on economic growth.

v. Ratio of Government Expenditure to Real GDP

This variable refers to the ratio of the sum of recurrent and capital budget of the Ethiopian government to real GDP. To avoid double counting government expenditure on human capital is deducted from total government expenditure .Similarly, since ODA is included in the model as one explanatory variable; government expenditure is taken only the expenditures from domestic sources (excluding the external assistance and loan). It is entered in to the model as a share of GDP. Since, budgetary expansion would boost the economy and would cause an increase in the real GDP growth rate, the sign expected from the coefficient of public spending is positive

vi. Ratio of Official Development Assistance to Real GDP

The view on the relationship between official development assistance aid and economic growth can be classified in to three. The first view is that aid has a positive contribution to the socio-economic status of the recipient country. The second argument rests on the idea that aid might lead to poor or negative productivity by discouraging alternative development policies and institutions (Rajan and Subramanian, 2005; Ekanayake and Chatrna ,2008). The other argument is that the marginal contribution of aid depends on the institutional environment (policy) of the recipient country. If there is good economic policy environment, it is crucial for the efficient allocation of aid to investment which has a positive impact on the economy. However, it will have little or no impact on economic growth if there is institutional destruction and capacity constraints (Hansen and Tarp, 2000).Therefore, since Ethiopia is among the main aid recipient countries in Africa; it is entered in to the model as one control variable.

vii. Dummy Variable

Changes in economic policies can influence the performance of the economy through investment on human capital and infrastructure, improvement in political and legal institutions and so on (Easterly, 1993). On the other hand, recurrent drought and bad weather condition have a negative impact on the economy, especially in developing countries that are predominantly dependent on agriculture. Therefore, policy change dummy (D1) and recurrent drought dummy (D2) are added in to the model. The dummy for changes in economic policies take zero for the period 1974/75-1991/92 and one otherwise. Similarly, the drought dummy takes zero, if there was relatively good weather condition and one if there was drought. The drought periods are determined based on the findings of (Webb, Braun, and Yisehac, 1992; Viste, Korecha, and Sorteberg , 2012).

All of the variables discussed above are given in logarithm form (except the policy change and drought dummy). The log-linear form of specification enables the researcher to interpret the coefficient of the dependent variables directly as elasticity with respect to the independent variables (Sarmad, 1988). In addition it is also useful for accommodating the hetreoskedasticity problem (Goldstein and Khan, 1976).

4. RESULTS AND DISCUSSION:

4.1 **Augmented Dicky-Fuller Unit Root Test:** In order to determine the degree of stationarity, a unit root testing is carried out through the standard Augmented Dicky-Fuller (ADF) test. This test was undertaken to check the order of integration of the variables. The test was done for two alternative specifications. First it is tested with constant but no trend, and then it is tested with constant and trend (See Table.1).

Variables (At level and 1st difference)	t-stat (with intercept but no rend)	t-stat (with intercept and trend)
LnLAB	-2.3066	-1.9913
Δ LnLAB	-5.7451***	-5.8121***
LnGCF	-1.5491	-3.4126*
Δ LnGCF	-4.3045***	-4.2318**
LnEHC	-0.2712	-1.9382
Δ LnEHC	-4.0889***	-3.9826**
LnHHC	-1.1560	-4.2745***
Δ LnHHC	-5.5383***	-5.4463***

LnGOEX	-2.6037	-2.4077
Δ LnGOEX	-4.6049***	-4.6030***
LnODA	-1.3859	-2.0645
Δ LnODA	-6.3378***	-6.3233***
LnGDPPC	0.3360	-0.5261
ΔLnGDPPC	-4.5721***	-5.4292***

Table 1: ADF unit root test results
Source: Author's Calculations.

Note: The rejection of the null hypothesis is based on MacKinnon (1996) critical values. Akaike information criterion (AIC) is used to determine the lag length while testing the stationarity of all variables. The ***, ** and * sign indicates the rejection of the null hypothesis of non-stationary at 1%, 5% and 10% significant level respectively

The results from this test show that six of the variables are non-stationary in their levels (for both type of specifications) while the null of non-stationarity is not rejected for one variable (health human capital- with intercept and trend) at 5 % level of significance .On the other hand, in their first differences, all of the variables are stationary. These results indicate that, with intercept and trend, six of the variables are I (1) and one of them is I (0). Such results of stationarity test would not allow us to apply the Johansen approach of co-integration. This is one of the main justifications for using the ARDL approach (bounds test approach of cointegration) developed by Pesaran, Shin, and Smith (2001).

4.2 **Long run ARDL Bounds Tests For Co-integration:** The first task in the bounds test approach of co-integration is estimating the ARDL model specified in equation (22) using the appropriate lag-length selection criterion. In this paper Akaike Information Criterion (AIC) was taken as a guide and a maximum lag order of 2 was chosen for the conditional ARDL model. Then F-test through the Wald-test (bound test) is performed to check the joint significance of the coefficients specified in equation (22). The Wald test is conducted by imposing restrictions on the estimated long-run coefficients of real GDP per capita, labor force growth, gross capital formation, education human capital, health human capital, government expenditure and official development assistance. The computed F-statistic value is compared with the lower bound and upper bound critical values tabulated in Table CI (III) case IV of Pesaran, Shin, and Smith (2001) and Appendix-X case V of Narayan (2005).

Table 4. Pesaran et al. (2001) and Narayan (2005) lower and upper bound critical value

Description	**At 1% level**		**At 5 % level**	
	Lower bound , **I(0)**	Upper bound **I(1)**	Lower bound **I(0)**	Upper bound **I(1)**
Pesaran (2001) critical values for K=6	3.60	4.90	2.87	4.00
Narayan (2005) critical values for K=6	4.53	6.26	3.33	4.70

Source: Pesaran, Shin, and Smith (2001) and Narayan (2005) tables.

As it is depicted in Table-5 below, with an intercept and trend, the calculated F statistics 9.536 is higher than the Pesaran, Shin, and Smith (2001) and Narayan (2005) upper bound critical values at 1% level of significance. This implies that the null hypothesis of $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$ (there is no long-run relationship) against its alternative $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_6 \neq \beta_7 \neq 0$ (there is long-run relationship) is rejected based on the Pesaran, Shin, and Smith (2001) and Narayan (2005) critical values at 1% level of significance.

Table 5. Bounds test for co-integration analysis

Description	Value
Number of observation	37
Optimal Lag length of the model	2
Calculated F-statistic	9.536

Source: Author's Calculations.

4.3 **. Long-run Model Estimation:** This result indicates us the existence of a long-run relationship among real GDP per capita, labor force, gross capital formation, education human capital, health human capital, government expenditure and official development assistance. After confirming the existence of long-run co-integration relationship among the variables, the estimated long-run relationship between the variables are estimated and the estimated coefficients after normalizing on real GDP per capita (GDPPC) are reported in Table 6.

Table 6. Estimated long run coefficients using the Autoregressive Distributed Lag Approach :ARDL (1,0,2,2,2,2,1) selected based on Akaike Information Criterion

Dependent variable is LnGDPPC				
Regressor	**Coefficients**	**S.E**	**T-Ratio**	**Prob**
LnLAB	0.09724	0.11326	0.8586	0.404
LnGCF	-0.74489	0.37269	-1.9987	0.064
LnEHC	0.50965	0.14294	3.5656	0.003***
LnHHC	0.59292	0.21315	2.7817	0.014**
LnGOEX	-0.45653	0.18191	-2.5096	0.024**
LnODA	-0.17643	0.06854	-2.5740	0.021**
Policy change dummy(D1)	0.00804	0.10184	0.0790	0.938
Drought dummy (D2)	-0.16527	0.04093	-4.0377	0.001***
Constant	4.22870	1.80160	2.3472	0.033**
Trend	-0.01307	0.01871	-0.6987	0.495

R-Squared	**0.98729**	**S.D. of Dependent Variable**	**0.23960**
R-Bar-Squared	0.97118	Residual Sum of Squares	0.02482
S.E. of Regression	0.04068	Equation Log-likelihood	77.2398
F-stat.	61.305[0.000]	Akaike Info. Criterion	57.2398
DW-statistics	2.1965	Schwarz Bayesian Criterion	41.6863
Mean of Dep. Variable	7.0529		

Source: Author's Calculations.

Note: The ***, ** and * sign indicates the significance of the coefficients at 1%, 5% and 10% significant level respectively.

As it is shown in Table-6, the estimated coefficients of labor force, health human capital and education human capital, policy change dummy and drought dummy have the hypothesized signs while gross capital formation, government expenditure and official development assistance have unexpected signs. In addition, the estimated coefficients of education human capital, health human capital, government expenditure, official development assistance, and drought dummy are statistically significant while labor force, gross capital formation, and policy dummy are not statistically significant.

Since I have specified my growth model in a log-linear form, the coefficient of the dependent variable can be interpreted as elasticity with respect to real GDP per capita. The coefficient of health is 0.5929. This indicates that, in the long run, holding other things constant, a one percent change in health (proxied by the ratio of public health expenditure to GDP) brought 0.5929 percent change in real GDP. Next to health, education has significant long run impact on the Ethiopian economy .A one percent increase in secondary school enrolment has resulted in 0.5096 percent change in real GDP per capita. The findings of this research concerning the long run positive impact of the education and health human capital are consistent with the endogenous growth theories (mainly advocated and/or developed by Lucas (1988) , Romer (1990), Mankiw, Romer and Weil (1992)) which argue that improvement in human capital (skilled and healthy workers) leads to productivity improvement that enhances output. With respect to the researches made in Ethiopia, the finding of this research is also similar to Teshome (2006) and Tofik (2012).

On the other hand, government expenditure and official development assistance and drought have a significant negative impact to the Ethiopian economy. The significant negative impact of government expenditure on the Ethiopian economy is consistent with the findings of Tofik (2012) and Teshome (2006) entailing the dominance of the unproductive and inefficient government spending that could not add any value to the economy (like wages and salaries, rent, debt servicing and transfer payments). The finding of this research in relation to ODA is also similar to the findings of Rajan and Subramanian (2005), Ekanayake and Chatrna (2008), Mallik (2008), and Tasew (2011). Labor force growth has no any significant impact on real GDP per capita. This may be due to the combined effect of high population growth and low productivity of the labor force. Further, the unexpected sign of gross capital formation is similar to the findings of Martha (2008) and Tadesse (2011). The unexpected sign of the coefficient of GCF contradicts with economic growth theories. In my opinion, it may be data and/or valuation problem, but it is difficult to justify the exact reason behind such unexpected result using this research. Hence, further detailed research should be done to identify the reason behind such result (unexpected sign of GCF).

4.3.1 ***Long-run diagnostic tests*****:** To check the verifiability of the estimated long run model, some diagnostic test is undertaken. The results reported in Table-7 indicate that there is no error autocorrelation and heteroskedasticity, and the errors are normally distributed. In addition the Ramsey functional form test confirms that the model is specified well .Hence, the relationship between the variables is verifiable or valid.

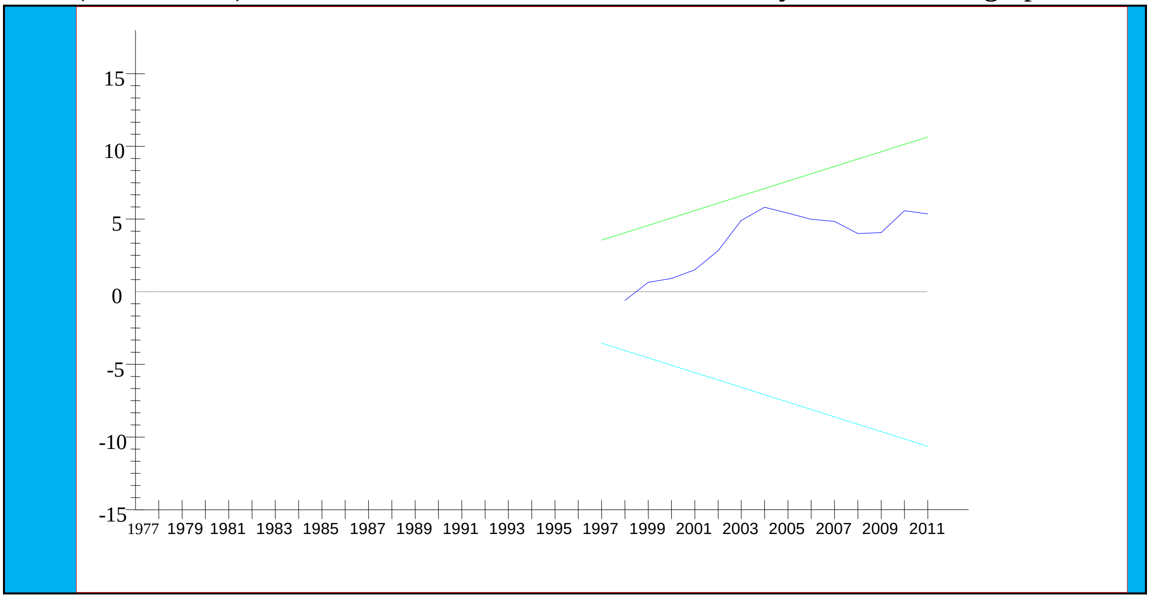
Table 7. Long-run diagnostic tests

Test Statistics	LM Version	F Version
Serial Correlation test	CHSQ(1)= 0.58187[0.446]**	F(1, 14) = 0.23668[0.634]**
Functional Form test	CHSQ(1)= 1.06340[0.302]**	F(1, 14) = 0.43869[0.519]**
Normality test	CHSQ(2)= 0.79174[0.673]**	Not applicable
Heteroscedasticity test	CHSQ(1)= 0.00974[0.921]**	F(1, 33) = 0.00919[0.924]**

Source: Author's Calculations.

Note: The sign ** indicates the significance of the coefficients at 5% level of significance. The test for serial correlation is the 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, the test for heteroskedasticity is based on the regression of squared residuals on squared fitted values.

In addition to the above diagnostic tests, the stability of long run estimates has been tested by applying the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) test. Such tests are recommended by Pesaran and Shin (1999, 2001). Since the test statistics of this stability tests can be graphed, we can



identify not only their significance but also at what point of time a possible instability (structural break) occurred. If the plot of CUSUM and CUSUMSQ statistic moves between the critical bounds (at 5% significance level), then the estimated coefficients are said to be stable.

Fig 5. Plot of cumulative sum of recursive residuals

Source: Author Calculations.

Note: The straight lines represent critical bounds at 5% significance level

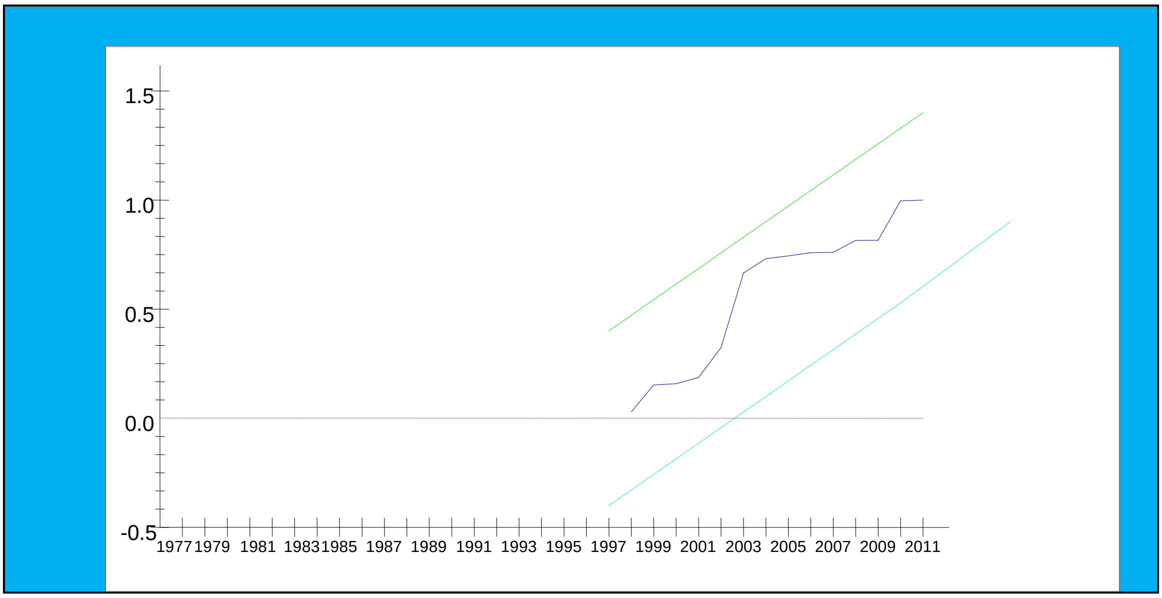


Fig 6. Plot of cumulative sum of squares of recursive residuals

Source: Author Calculations.

Note: The straight lines represent critical bounds at 5% significance level

The results of both CUSUM and CUSUMSQ test are reported in Figures 5 and 6 above. As can be seen from the first figure, the plot of CUSUM test did not cross the critical limits. Similarly, the CUSUMSQ test shows that the graphs do not cross the lower and upper critical limits. So, we can conclude that long and short runs estimates are stable and there is no any structural break. Hence the results of the estimated model are reliable and efficient.

4.4 . **Short run Error Correction Estimates:** After the acceptance of long-run coefficients of the growth equation, the short-run ECM model is estimated. The coefficient of determination (R-squared) is high explaining that about 90.235 % of variation in the real GDP is attributed to variations in the explanatory variables in the model. In addition, the DW statistic does not suggest autocorrelation and the F-statistic is quite robust.

The equilibrium error correction coefficient, estimated -0.7366 is highly significant, has the correct sign, and imply a very high speed of adjustment to equilibrium after a shock. Approximately 73.66 percent of the disequilibrium from the previous year's shock converges back to the long-run equilibrium in the current year. Such highly significant Error correction term is another proof for the existence of a stable long run relationship among the variables (Banerjee, et al., 2003).

The estimated short-run model reveals that education is the main contributor to real GDP per capita change followed by gross capital formation (one period lagged value) and government expenditure (one period lagged value). When enrolment increases by one percent, real GDP per capita increases by 0.76867 percent while the same percentage change in its one period lagged value resulted in about 0.7150 percent rise in real GDP per capita. But, unlike its long run significant impact, health has no significant short run impact on the economy. Even its one period lagged value has a significant negative impact on the economy. This could be due to the reason that health expenditure may have big impact on the people who have no positive impact on the economy. Due to this, it may increase the dependency ratio that dilutes resources of the economy that would have been invested in creating new assets and values. The other possible reason could be high rate of unemployment. That means, even though health status of the labor force increases in the short run, until it is employed it will dilute resources that would have been allocated for new investment.

Table 8. Error correction representation for the selected Autoregressive Distributed Lag model: ARDL (1,0,2,2,2,2,1) selected based on Akaike Information Criterion

Dependent variable is ΔLnGDPPC				
Regressor	**Coefficients**	**S.E**	**T-Ratio**	**Prob**
ΔLnLAB	0.07163	0.09103	0.7869	0.441
ΔLnGCF	0.11542	0.07965	1.4492	0.163
ΔLnGCF(-1)	0.31605	0.10660	2.9648	0.008***
ΔLnEHC	0.76867	0.21877	3.5136	0.002***
ΔLnEHC(-1)	0.71501	0.22209	3.2194	0.004***
ΔLnHHC	-0.06594	0.07250	-0.9095	0.374
ΔLnHHC(-1)	-0.18325	0.08123	-2.2560	0.035**
ΔLnGOEX	-0.10862	0.13065	-0.8314	0.416
ΔLnGOEX(-1)	0.25814	0.10822	2.3854	0.027**
ΔLnODA	-0.03819	0.05875	-0.6501	0.523
Policy change Dummy(D1)	0.00593	0.07500	0.0790	0.938
Drought Dummy(D2)	-0.12174	0.02871	-4.2405	0.000***
Constant	3.11490	1.58110	1.9701	0.063*
Trend	-0.00963	0.01465	-0.6573	0.518
ECM(-1)	-0.73660	0.19218	-3.8329	0.001***
Where , *ECM* = RGDP-0.097240*LAB+ 0.74489*PCAP-0.50965*EHC-0.59292*HHC +0.45653*GOEX +0.17643*ODA -0.0080438* D1 + 0 .16527* D2 -4.2287* constant + 0.013072*Trend				

R-Squared	**0.90235**	**S.D. of Dependent Variable**	**0.08646**
R-Bar-Squared	0.77867	Residual Sum of Squares	0.02482
S.E. of Regression	0.04068	Equation Log-likelihood	77.2398
F-stat.	9.9013[0.000]	Akaike Info. Criterion	57.2398
DW-statistics	2.19650	Schwarz Bayesian Criterion	41.6863
Mean of Dep. Variable	0.01314		

Source: Author's Calculations.

Contrary to its insignificant long run impact, one period lag of gross capital formation has a positive contribution to economic growth at 5 percent level. Similarly, a one period lagged value of government expenditure has a positive impact on real GDP per capita. In addition, unlike its negative long run effect, official development assistance has no significant effect on the economy in the short run.

4.4.1 ***Short-run diagnostic tests:*** To check the verifiability of the estimated short run model, some diagnostic test is undertaken. The results reported in Table-9 indicate that there is no error autocorrelation and heteroskedasticity, and the errors are normally distributed. In addition the Ramsey functional form test confirms that the model is specified well .Hence, the relationship between the variables is verifiable or valid.

Table 9.Short run diagnostic test

Test Statistics	**LM Version**	**F Version**
Serial Correlation test	CHSQ(1)= 0.07801[0.780]**	F(1, 19) = 0.04244[0.839]**
Functional Form test	CHSQ(1)= 1.17343[0.279]**	F(1, 19) = 0.64780[0.431]**
Normality test	CHSQ(2)= 0.72033[0.688]**	Not applicable
Heteroscedasticity test	CHSQ(1)= 16.55290[0.281]**	F(1, 33) = 1.28188[0.299]**

Source: Author's Calculations.

Note: The sign ** indicates the significance of each diagnostic tests at 5% level of significance. The test for serial correlation is the LM test for autocorrelation, the test for functional form is Ramsey's RESET test, the test for normality is based on Jarque-bera test, and the test for heteroskedasticity is based on Breusch-Pagan-Godfrey test.

4.5 **The Pair wise Granger Causality Results:** A granger causality test is made to identify the direction of causality between the dependent variable, education and health. The result is reported in Table-10 below. The result revealed that, at lag length of one, there is significant causality between real GDP per capita, education human capital (proxied by secondary school enrolment) and health human capital (proxied by the ratio of public health expenditure to real GDP).

There is a Uni-directional causal relationship from health to real GDP per capita while a Bi-directional relationship is identified between real GDP per capita and education. The bidirectional relationship between real GDP per capita and education implies that education (secondary school enrolment) is not only a cause for real GDP per capita change but it is also an effect. On the other hand, when the lag length of the ARDL model increases to two, there is no any significant causality between real GDP per capita, education human capital and health human capital.

Null Hypothesis	**Lag length 1**		**Lag length 2**	
	F-stat	**Prob.**	**F-stat**	**Prob.**
EHC does not Granger Cause GDPPC	5.89901	0.0208**	2.22794	0.1253
GDPPC does not Granger Cause EHC	12.9837	0.0010***	1.64900	0.2092
HHC does not Granger Cause GDPPC	3.91545	0.0056***	1.97634	0.1562
GDPPC does not Granger Cause HHC	0.54944	0.4638	2.42323	0.1058

Table 10. Pair wise granger causality test

Source: Author's Calculations.

Note: The signs *** and ** indicate the significance of the coefficients at 1% and 5% level of significance respectively.

5. CONCLUSION AND POLICY IMPLICATION:

5.1 Conclusion: The main objective of the study was to analyze the impact of human capital development on economic growth in Ethiopia (using real GDP per capita, as a proxy for economic growth). To determine the impact of human capital development on economic growth (real GDP per capita), the study has used the ARDL Approach to co-integration and the error correction model (ECM).

The main finding of this paper is that in the long run health human capital (proxied by the ratio of public health expenditure to GDP) and education human capital (proxied by secondary school enrolment) are the main contributors to real GDP per capita rise. In other words, the result reveals that economic performance can be improved significantly when the ratio of public expenditure on health services to GDP increases and when secondary school enrolment improves. Holding other things constant, a one percent change in health (proxied by the ratio of public health expenditure to real GDP) brought 0.5929 percent change in real GDP. Next to health, education has significant long run impact on the Ethiopian economy .A one percent increase in secondary school enrolment has resulted in 0.5096 percent change in real GDP per capita. However, government expenditure, official development assistance and recurrent drought have negative impact on the economy. The findings of this research concerning the long run positive impact of the education and health human capital are consistent with the endogenous growth theories (mainly advocated and/or developed by Lucas (1988) , Romer (1990), Mankiw, Romer and Weil (1992) which argue that improvement in human capital (skilled and healthy workers) leads to productivity improvement and thereby output growth. With respect to the researches made in Ethiopia, the finding of this research is also similar to Teshome (2006) and Tofik (2012).

In the short run, the coefficient of error correction term is -0.7366 suggesting about 73.66 percent annual adjustment towards long run equilibrium. This is another proof for the existence of a stable long run relationship among the variables. The estimated short-run model reveals that education is the main contributor to real GDP per capita change followed by gross capital formation (one period lagged value) and government expenditure (one period lagged value). When enrolment increases by one percent, real GDP per capita increases by 0.7686 percent while the same percentage change in one period lagged value of it resulted in about 0.7150 percent rise in real GDP per capita. But, unlike its long run significant impact, health has no significant short run impact on the economy. Even its one period lag has a significant and negative impact on the economy. This could be due to the reason that health expenditure may have big impact on the people who have no positive impact on the economy. As a result, dependency ratio may increase that dilute resources of the economy that would have been invested in creating new assets and values.

5.2 Policy Implication: The results of this study have important policy implications. In order to improve economic growth, public expenditure needs to be better prioritized towards basic health service provision. In addition, to achieve economic growth, more resources should be devoted to educate the citizens of the country. Such measures have a large impact on human productivity which leads to improved national output per capita. In other words, as more people become educated and healthy, they will increase their productivity in the long run. Although not investigated in this paper, one of the ways through which education and health affects economic wellbeing is its externalities effect. That means, education and health may have indirect benefits (positive spillovers) that enhance productivity in the long run.

Hence policy makers and / or the government should strive to create institutional capacity that increase school enrolment and improve basic health service. That means, the policy makers and the government should center on securing more resources and structures that are essential and appropriate for better school enrolment and improved basic health service provision. Such measures should focus not only on creating new institutional capacity, but also on strengthening and changing the existing institutional setups of the education and health sectors of Ethiopia that produce quality manpower. In addition, the government should also continue its leadership role in creating enabling environment that encourage better investment in education and health by the private sector. Because, healthier participation of the private sector in the education and health sectors can speed up the creation of human capital in Ethiopia.

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ANNEX

Table-A. Autoregressive Distributed Lag estimates (Dynamic estimation Results) ARDL(1,0,2, 2,2,2,1) selected based on Akaike information Criterion

Dependent variable is LnGDPPC				
Regressor	**Coefficient**	**Standard Error**	**T-Ratio**	**Prob**
LnGDPPC(-1)	0.2634	0.1922	1.3706	0.191
LnLAB	0.0716	0.0910	0.7869	0.444

LnGCF	0.1154	0.0797	1.4492	0.168
LnGCF(-1)	-0.3481	0.1221	-2.8501	0.012**
LnGCF (-2)	-0.3161	0.1066	-2.9648	0.010***
LnEHC	0.7687	0.2188	3.5136	0.003***
LnEHC(-1)	0.3218	0.2214	1.4534	0.167
LnEHC(-2)	-0.7150	0.2221	-3.2194	0.006***
LnHHC	-0.0659	0.0720	-0.9095	0.377
LnHHC(-1)	0.3194	0.1120	2.9878	0.011**
LnHHC(-2)	0.1833	0.0812	2.2560	0.039**
LnGOEX	-0.1086	0.1307	-0.8314	0.419
LnGOEX(-1)	0.0305	0.1177	0.2591	0.799
LnGOEX(-2)	-0.2581	0.1082	-2.3854	0.031**
LnODA	-0.0382	0.0586	-0.6501	0.525
LnODA(-1)	-0.0918	0.0673	-1.3636	0.193
Policy change dummy(D1)	0.0059	0.0750	0.0790	0.938
Drought dummy (D2)	-0.1217	0.0287	-4.2405	0.001***
Concant	-3.1149	1.5811	1.9701	0.068*
Trend	-0.0096	0.0147	-0.6573	0.521

R-Squared	**0.98729**	**S.D. of Dependent Variable**	**0.23960**
R-Bar-Squared	0.97118	Residual Sum of Squares	0.02482
S.E. of Regression	0.04068	Equation Log-likelihood	77.2398
F-stat.	61.3046[.000]	Akaike Info. Criterion	57.2398
DW-statistics	2.1965	Schwarz Bayesian Criterion	41.6863
Mean of Dep. Variable	7.0529		

Diagnostic tests

Test Statistics	**LM Version**	**F Version**
Serial Correlation test	CHSQ(1)= 0.58187[0.446]**	F(1, 14) = 0.23668[0.634]**
Functional Form test	CHSQ(1)= 1.06340[0.302]**	F(1, 14) = 0.43869[0.519]**
Normality test	CHSQ(2)= 0.79174[0.673]**	Not applicable
Heteroscedasticity test	CHSQ(1)= 0.00974[0.921]**	F(1, 33) = 0.00919[0.924]**

Source: Author's Calculations.

Table-B. Estimated model for Wald test (Bound test)

Dependent Variable: Δ (GDPPC) Method: Least Squares, Included observations: 34 after adjustments				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
GDPPC(-1)	-1.104085	0.228872	-4.824025	0.0170
GCF(-1)	-2.160438	0.560328	-3.855665	0.0308
LAB(-1)	0.057786	0.128485	0.449748	0.6834
HHC(-1)	0.939590	0.302394	3.107171	0.0530
EHC(-1)	1.094549	0.220404	4.966099	0.0157

ODA(-1)	0.043176	0.083182	0.519051	0.6396
GOEX(-1)	0.214299	0.287374	0.745713	0.5100
Δ(PCAP)	0.201688	0.074389	2.711273	0.0731
Δ (LAB)	0.322890	0.120570	2.678029	0.0752
Δ (EHC)	1.554877	0.248026	6.268996	0.0082
Δ (HHC)	-0.011941	0.060132	-0.198583	0.8553
Δ (ODA)	-0.097219	0.056548	-1.719236	0.1841
Δ (GOEX)	0.545869	0.179531	3.040525	0.0558
Δ (GDPPC(-1))	-0.586560	0.246184	-2.382608	0.0974
Δ (GCF(-1))	1.607739	0.424163	3.790379	0.0322
Δ (LAB(-1))	0.253491	0.074404	3.406950	0.0422
Δ (HHC(-1))	-0.505216	0.168145	-3.004638	0.0575
Δ (EHC(-1))	1.145734	0.269748	4.247425	0.0239
Δ (ODA(-1))	-0.391221	0.113192	-3.456257	0.0408
Δ (GOEX(-1))	0.325803	0.135489	2.404651	0.0955
Δ (GDPPC(-2))	-0.239669	0.162575	-1.474205	0.2369
Δ (GCF(-2))	0.287883	0.146950	1.959056	0.1450
Δ (LAB(-2))	0.179930	0.069755	2.579451	0.0818
Δ (HHC(-2))	-0.149354	0.081369	-1.835517	0.1638
Δ (EHC(-2))	0.759719	0.232133	3.272775	0.0467
Δ (ODA(-2))	-0.148140	0.079559	-1.862026	0.1595
Δ (GOEX(-2))	0.208115	0.111335	1.869277	0.1584
Constant	-0.488530	1.941708	-0.251598	0.8176
D1	0.137103	0.079049	1.734402	0.1813
D2	-0.195315	0.033199	-5.883104	0.0098
Trend	-0.046724	0.020873	-2.238541	0.1111
R-squared	0.993925	Mean dependent var		0.014118
Adjusted R-quared	0.933178	S.D. dependent var		0.087564
S.E. of regression	0.022635	Akaike info criterion		-5.342851
Sum squared resid	0.001537	Schwarz criterion		-3.951169
Log likelihood	121.8285	Hannan-Quinn criter.		-4.868247
F-statistic	16.36174	Durbin-Watson stat		2.612301
Prob(F-statistic)	0.020152			

Source: Author's Calculations**.**

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