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The Impact of Foreign Aid on Economic Growth of Ethiopia (Through Transmission Channels)

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Abstract: The study has examined the impact of foreign aid on economic growth in Ethiopia through transmission channel (i.e through financing investment) over the period 1980/01 to 2013/14 using multivariate co integration analysis. The empirical result from the growth model shows that aid has a significant positive impact on growth in the long run. The empirical result from investment model also indicated that the positive and significant contribution of aid on investment in the long run. In other words the theoretical view of the gap models which is Aid can enhance growth by financing the saving gap is proven in this study. The growth equation further revealed that rainfall variability has a significant negative impact on economic growth. This study indicated also that the country has no problem of capacity constraint as to the flow of foreign aid.

Keywords: Foreign Aid, Economic Growth, Cointegration, VECM, Ethiopia

1. Introduction

Ethiopia is the second largest populous country in Africa, with an estimated population of nearly 79 million (in 2007) and a growth rate of 2.6 percent per year. Ethiopia is a predominantly rural and young society with 84% living mainly in densely populated highland settlements. It is also one of the poorest countries in the world (with 38.7% of the population being below the poverty line in the year 2004). The Ethiopian economy is a subsistence one that is highly dependent on agriculture, which in turn depends on vagaries of nature. Over 85 percent of the population depends on this sector for earning the means of its livelihood. Agriculture accounts for almost half of the GDP and more than 90 percent of the export earnings. However, the share of agriculture is declining steadily whereas the share of the service sector in GDP is rising recently.

On the other hand, the share of the manufacturing sector is relatively static which is between 13 and 14 percent only (MoFED, 2010).

Despite the fact that the history of the growth performance was poor in the past; the country has experienced strong economic growth in the current time (especially, since 2003/04). According to Ncube, Lufumpa and Ndikumana (2010) real GDP averaged 11.2 % per annum during the 2003/04 and 2008/09 period, placing Ethiopia among the top performing economies in sub Saharan Africa. This growth performance is well in excess of the population growth rate and the 7 percent rate required for attaining the MDG goal of halving poverty by 2015. However, there are a number of challenges to sustain the current trend of economic growth. The high dependency of economic growth on timely and adequate rainfall and the country's vulnerability to terms of trade and similar external shocks are structural constraints facing the economy. There is a strong correlation between weather condition and economic performance in Ethiopia.

Alemayehu (2001) argued that in explaining growth in Ethiopia it will be necessary to examine the agricultural sector, its linkage with the other sectors and household behavior in rural Ethiopia.

The other most important permanent feature of the Ethiopian economy is the presence of resource (financial) gap. The resource gap can be explained as the presence of savings investment gap, foreign exchange gap and fiscal gap. In recent years the savings-investment gap has been widening from an average of 1.1% of GDP during the Imperial period (1960-74) to 6% of the GDP during the Derg period (1974-91) to 11.7% of the GDP in the EPRDF (1991/92- 2007/08). The presence of resource gap (gross domestic investment-gross domestic savings) forces the country to rely on an inflow of foreign finance (specifically foreign aid) to bridge the gap.

Thus, the presence of these resource gaps in one way or another shows that the domestic economy is not capable of generating enough finance to close these gaps and make the country's reliance on foreign capital inflow compulsory.

Despite massive inflow of aid to developing countries and extensive empirical work for decades on the aid-growth link, the aid effectiveness literature remains controversial. An important objective of much Official Development Assistance ('foreign aid') to developing countries is the promotion of economic development and welfare, usually measured by its impact on economic growth. Yet, after decades of capital transfers to these countries, and numerous studies of the empirical relationship between aid and growth, the effectiveness of foreign aid in achieving these objectives remains questionable (Durbarry, Gemmel and Greenway, 1998).

An empirical investigation on the relationship between aid and growth by Gomannee, Girma and Morrissey(2005) on 25 sub-Saharan Africa countries from 1970 to 1997 show that aid appears to be ineffective. Griffine and Enos (1970), Weisskopf (1972) suggested that even if foreign aid can be a substitute for saving, it has a crowding out effect since large fraction of is used for consumption rather than investment.

However, other studies reject the aid ineffectiveness claim and prove that aid is effective in promoting development in recipient countries. Tarp (2009) argues that aid has been and remains an important tool for enhancing the development prospect of poor nations. Burnside and Dollar (1997 and 2000) found that aid has a positive effect on growth in an environment of good fiscal, monetary, and trade policies.

The literature on the impact of aid on economic growth are mainly in the cross sectional analysis of developing countries. Most of these cross sectional analysis suggest that the growth impacts of foreign assistance vary among countries that pointed out the need for empirical study for individual countries.

Despite a number of empirical works that has been done on the impact of aid on economic growth in Ethiopia little has been done in analyzing its impact through financing investment in which further study is still required. Thus, this paper will attempt to examine the growth impacts of official development assistance through financing investment by using a multivariate co integration analysis.

In broad spectrum, the objective of this paper is to assess the effectiveness of foreign aid in enhancing economic growth through financing investment.

Specifically this paper tries to:

- Analyze impacts of foreign aid on the investment
- Determine whether there is absorptive capacity constraint of the economy as to the flow of foreign aid or not.

2. Data and Methodology

2.1. Data Type and Source

For the purpose of analyzing the impact of foreign aid on the economic growth through its transmission channels, time serious data, from 1980/01 to 2013/14, would be used. For this achievement secondary data is collected from different government ministers and authorities' data base as well as international financial organizations. These include Minister of Finance and Economic Development, publications of National Bank of Ethiopia (NBE), Ethiopian Investment Authority, Central Statistical Authority (CSA), Ethiopian Economic Association (EEA), National metrology agency, International Monetary Fund(IMF) and World Bank(WB) data base.

2.2. Model Specification

This paper would try to assess the impact of aid on growth by considering investment as transmission channel by using multivariate co integrated VAR approach and it will be examined by specifying the following two equations based on the equations that are derived by Gomanee et al (2002).

2.2.1. Growth Equation

The growth model, which is used in this study, is based on Harrod –Domar (1946) growth model in which the growth of a given country depends on the amount of investment.

$$g = \kappa/Q.I = \delta I \tag{1}$$

Where δ = incremental capital output ratio,

I = investment level,

Q = output level, and

g = growth rate of output.

However, recently different scholars come to include various variables that are believed to affect the growth of a country. Rana and dowling (1988) extended the Harrod Domar growth work by including variables like labor force and policy variables.

Since the objective of this paper is to assess the impact of aid on growth, attempts are made to include variables to further improve the above model and to be in line with the objective.

Thus, the growth function is given by:

$$RGDP = f\,(INVo, AID, HC, RFv, LAB, (A)^2) \tag{2}$$

Where, RGDP = Real Gross domestic product

A^2 = aid squaried as a ratio of GDP

RFv = rain fall variability

INVo = investment level that is not financed by aid

AID = aid as a ratio of GDP

HC = human capital proxied by education expenditure

LAB = labor force as a ratio of total population

Accordingly, the model to be estimated can be specified as follows:

$$\ln RGDP = \beta_0 + \beta_1 INVo + \beta_2 \ln AID + \beta_4 HC + \beta_5 \ln LAB + \beta_6 A2 + \beta_{7RFv} + \varepsilon_i \quad (3)$$

Dependent Variable

Real GDP: The dependent variable of the model is Real GDP

Explanatory Variables

Beside foreign aid a number of factors are expected to influence the economic growth. These variables are briefly described with their respective expected relation to the economic growth.

Non-aid Financed Investment (INVO): This is the ratio of non-aid financed investment to GDP. The variable INVO would be developed by using the technique of generated regressor of Gomannee, Girma, and Morrissey (2005). Using residuals from an aid-investment bi-variate regression i.e. aid is used as the only explanatory variable; a variable is constructed representing that part of investment which is not financed by foreign aid (INVO). Then INVO is used in place of investment in the growth regression. It is worth noting that this transformation affects only the estimated coefficient on the aid variables. Empirical aid-growth regressions usually omit investment from their equation. Aid is intended to affect growth via its effect on investment. However, not all aid is intended for investment, and not all investment is financed by aid. If investment is omitted from the growth equation, there will be potential omitted variable bias—any effect of investment on growth is attributed to the other variables (especially aid) as argued by Girma, Gomannee and Morrissey (2005). If both aid and investment are included, there will be a problem of double counting (as part of aid is used for investment), and the coefficients are biased. Therefore, to address such problems Gomannee, Girma, and Morrissey (2005) propose the technique of generated regressors (the mechanism of residual generated regressor). Using the technique, non-aid financed investment (INVO) is generated as:

$$INVO = I - 0.04AID$$

Where, INVO = investment which is not financed by aid.

I = Total investment as ratio of GDP

AID = Official Development Assistance as ratio of GDP

Official Development Assistance (ODA): It is the ratio of Official Development Assistance (ODA) to GDP as defined by the DAC (Development Assistant Committee).

ODA is defined as pure grants and concessional flows from bilateral governments and their agencies as well as multilateral financing agencies to the developing countries at low rates of interest with maturity periods of a long-term nature, all of them containing a grant element of at least 25 %.

A^2: the square of ODA to GDP. This takes into account whether there is diminishing return to aid. The diminishing returns to aid hypothesis assume that an inflow of aid, above a certain threshold level, starts to have negative effects. This happens because of the limited absorptive capacity of recipient countries.

RFV: rainfall variability. In countries like Ethiopia where almost half of the GDP is generated from agriculture, it is imperative to incorporate climatic shocks (most importantly rainfall shocks) into the growth equation. And shocks in fact may have an important implication for aid effectiveness as shocks (rainfall) has the power to offset any positive contribution made by foreign aid. What is more, drought years are mostly followed by resurgence in the volume of aid flow to the country. Rainfall shock /variability (the annual deviation of rainfall from the normal pattern) influences the performance of the economy through its effect on the production and performance of the agricultural sector. In line with this argument, Alemayehu and Befekadu (2005) claimed that the high dependency of economic growth on timely and adequate rainfall is among the structural constraints facing the Ethiopian economy. Rainfall variability/shock is measured by the annual deviation of rainfall from the long term mean average rainfall i.e. rainfall variability (RFV) t =RFVt− RF', RF t - annual rainfall at period t, and RF' - the mean average rainfall. This helps us to identify the consequences of dependence on rain fed agriculture on the performance of the overall economy.

Labor Force (LAB): This represents labor force as a ratio of total population. That is age from 15-64 years as a percentage of total population;

Human Capital (HC): A wide range of growth models has treated human capital as a critical factor in determining growth rate of output (Lucas, 1988). It is an important source of long-term growth, either because it is a direct input to research (Romer, 1990) or because of its positive externalities (Lucas, 1988). Policies that enhance public and private investment in human capital, therefore, promote long-run economic growth. The inclusion of human capital variables in growth models are intended to capture quality differences in the labor force, as non-physical capital investment increases the productivity of the existing labor force. They commonly relate to education and are measured by an index of educational attainment, by mean years of schooling, or by school enrolment (Barro and Lee, 1993). However, none of this data are found in the required level so we will use expenditure on education as a proxy to human capital.

2.2.2. Investment Equation

The literature on foreign resources inflow emphasizes the existence of positive correlation between foreign inflow (Foreign aid) and investment. For instance, Gap theories consider foreign inflow as an important growth inducing element through bridging the gap between the available resources and the required investment.

These theoretical arguments of the gap models are the bases for the formulation of investment equation. It is identified that domestic saving and foreign aid are the two determinants of investment. In addition, macro economic instability which is proxed by inflation and debt servicing are identified as factors that affect investment of a given country. Those are explained as follows:

Debt Service (DS): This is ratio of debt servicing to GDP.

Official development assistance (foreign aid) has a loan component in which it has to be paid in the future in the form of debt service with their service interest. If the recipient's payment fails to increase, debt servicing is likely to crowd out investment actively by consuming the available foreign exchange or through raising tax to finance the debt repayment. Therefore debt is one of the determining factors of investment in a given country.

Inflation (INF): annual average inflation rate. Inflation as one measure of macroeconomic instability is considered as a determinant of investment i.e. High rate of inflation is harmful because it raises the cost of borrowing and thus lowers the rate of capital investment, but at low, single-digit levels of inflation, the likelihood of such a trade-off between inflation and investment is minimal.

Thus in line with this argument, in this paper inflation is considered to see the potential impact of macroeconomic instability on investment.

Thus, the investment equation is identified as

$$INV = f\ (S, A, DS, INF) \quad (4)$$

Where, INV = investment as a ratio of GDP

S = Domestic saving as a ratio of GDP

AID = Aid as a ratio of GDP

INF=Annual inflation rate

DS = the ratio of debt servicing to GDP

Therefore, the model to be estimated can be specified as follows:

$$\ln INV = {}_{\beta}o + {}_{\beta}1\ln S + {}_{\beta}2\ln AID + 3_{\beta}INF + {}_{\beta}4\ln DS + \varepsilon i \quad (5)$$

2.3. The Unit Root Test

The standard classical methods of estimation which are used in the applied econometric work are based on a set of assumption one of these is that all variables are stationary. However, most economic variables are not stationary (Gujarati, 1995). A data series is said to be stationary if its error term has zero mean, constant variance and the covariance between any two – time periods depends only on the distance or lag between the two periods and not on the actual time which it is computed (Harris, 1995). On the other hand a time series is stationary if its mean, variance and auto covariance (at various lags) remain the same on matter at what point we measure them, i.e they are time invariant (Gujrati, 2004).

The unit root test is one of the mechanisms that enable us to check whether the time series data is stationary or not. There are several ways of testing the presence of unit root. In this paper unit root test will be conducted using Dickey-Fuller (DF) and Augmented Dickey- Fuller (ADF) tests.

2.4. Co-Integration Test

Most macroeconomic variables are found to be non stationary and showing trending overtime (Johansen, 1991). However, one can difference or de trend the variables in order to make the variables stationary. If variables become stationary through differencing, they are in the class of difference stationary process. On the other hand, if they are de trended, they are trend stationary.

Cointegration among the non stationary variables reflects the presence of long run relationship in the system, (Gujarati, 1995). There are two approaches used in testing for Cointegration. They are: (i) the Engle-Granger (two step algorism) and: (ii) the Johansen Approach

The Engle-Granger (E-G) method requires that for co-integration to exist, all the variables must be integrated of the same order. Hence, once the variables are found to have the same order of integration, the next step is testing for level of integration. This needs to generate the residual from the estimated static equation and test its stationarity.

Although, the Engle-Granger (EG) procedure is easily implemented, it is subject to several limitations.

The Johansen (1988) procedure enables estimating and testing for the presence of multiple co integration relationships, in a single step procedure. Moreover, it permits to estimate the model without priory restricting the variables as endogenous and exogenous. Under this procedure, the variables of the model are represented by a vector of potentially endogenous variables. Therefore, this paper will use the Johansen maximum Likelihood Procedure since it addresses the weakness of the E-G method.

2.5. Vector Error Correction Model (VECM)

Economic variables have short run behavior that can be captured through dynamic modeling. If there is long run relationship among the variables, an error correction model can be formulated that portray both the dynamic and long run interaction between the variables. In the previous discussion, it was shown that if two variables that are non-stationary in levels have a stationary linear combination then the two variables are co integrated. Co integration means the presence of error correcting representation. That is, any deviation from the equilibrium point will revert back to its long run path. Therefore, an ECM depicts both the short run and long run behavior of a system.

2.6. VAR Diagnostic Tests

Once the VAR models are estimated we should make some diagnostic tests which are important in order to make sure that the results obtained from VAR estimation can be used for forecasting or policy purposes. These post-estimation tests are mostly performed on the residual of the VAR and they include: the LM test for residual autocorrelation, Jarque-Bera test for residual multivariate normality, test for VAR stability and White test for the presence of heteroscedasticity in the VAR's residuals.

2.7. Residual Vector Normality Test

The Jarque-Bera normality test is used to determine whether the regression errors are normally distributed. It is a joint asymptotic test whose statistic is calculated from the skewness and kurtosis of the residuals.

2.8. Error Vector Autocorrelation Test

Testing for autocorrelation helps to identify any relationships that may exist between the current values of the regression residuals and any of its lagged values (Brooks, 2002). The null hypothesis of the LM test for autocorrelation is that the residuals are not serially correlated, while the alternative is that the residuals are serially correlated. If the P-value is less than 0.05 then we reject the null hypothesis (Harris, 1995). The test statistic is given by:

$$LM = (T- q)R\,\hat{e}^2 \quad (6)$$

Where, q is the degree of freedom and R ê 2 is the coefficient of determination obtained from the auxiliary regression; and the LM test statistic is chi-square distributed.

2.9. Stability Test

The test for stability checks whether the roots of the characteristic polynomial lies inside the unit circle. If all roots lie inside the unit circle then the VAR is considered as stable and can be used for policy analysis. We can also make use of variance decomposition and impulse response functions in our analysis if the VAR is stable.

2.10. Heteroscedasticity Test

The test for heteroscedasticity investigates whether the variance of the errors in the model are constant or not. Breusch-Pagan-Godfrey test is used to check whether the residuals are homoskedastic. It tests the null hypothesis that the residuals are both homoskedastic and that there is no problem of misspecification. The test regression is run by regressing each cross product of the residuals on the cross products of the regressors and testing the joint significance of the regression. If the test statistic is significant, that is, P value is less than 0.05; the null hypothesis of homoscedasticity and no misspecification will be rejected (Brooks, 2002: 445).

3. Result and Discussion

3.1. Unit Root Test Results

Since unit root tests are sensitive to the presence of deterministic regressors, three models are estimated. The most general model restrictive models i.e. with a constant is estimated first and with a drift and time trend and without either constant and trend, respectively, are estimated. A unit root test for each variable is performed on both levels and first differences. The result of the unit root test for the variables at level was presented in table below.

Table 3.1. *Unit root test results for variables at level.*

Variables		With drift only	With drift and trend	Only stochastic
LnRGDP		-2.724	-0.902	-2.425
LnAID		-0.607	-1.309	0.956
HC		2.254	3.474	1.625
RFv		-3.187	-3.09	-2.484
LnLAB		-0.855	3.382	-0.669
A^2		-0.878	-1.347	-0.725
LnS		-2.944	-3.006	-0.189
LnDS		-0.799	-1.283	0.684
INF		-2.768	-2.803	-1.112
LnINV		-1.088	-3.490	0.716
lnINVo		-2.197	-2.832	-1.201
Critical values	1%	-3.615588	-4.219126	-2.627238
	5%	-2.941145	-3.533083	-1.949248

Source; Eveiws 6 stastical output of ADF test at level.

The ADF test results show that all the variables (at levels) are non stationary with the three different specifications. That is, the test conducted fails to reject the null hypothesis of unit root in the three different specifications.

Therefore, to avoid spurious regression all these variables have to be differenced to transform them to stationarity. In the second stage, the order of integration of the non-stationary variables were performed proceeding in the same way by means of ADF tests applied to all series in first differenced form.

First difference of the each variable was generated by deducting one period lag from the variable of itself of successive period. After making the first difference of each series the usual unit root test of ADF were applied to determine their order of integration. The result of the test was presented below.

Table 3.2. *Unit root test results for variables (at 1st difference).*

Variables		With drift only	With drift and trend	Only stochastic
DlnRGDP		-5.348***	-6.273***	-4.819***
DLnAID		-6.431***	-6.754***	-6.265***
DHC		-3.860***	-3.832**	-2.505**
DRFv		-5.547	-5.621	-5.695
DlnLAB		5.794***	4.243***	4.245***
DA^2		-6.788***	-7.185***	-6.715***
DlnS		-7.626***	-7.599***	-7.719***
DlnDS		-6.069***	-6.289***	-5.995***
DlnTR		-4.617***	-4.554***	-4.680***
DINF		-8.957***	-8.844***	-9.069***
DlnINV		-8.864***	-8.587***	-8.451***
DINVo		-10.309***	-10.245***	-10.416***
Critical values	1%	-3.621023	-4.226815	-2.628961
	5%	-2.943427	-3.536601	-1.950117

Source; Eveiws 6 stastical output of ADF test at 1st difference.
Note ***, ** denotes significant at 1%, 5% significance level respectively.

The first differences of the variables are investigated for a unit root test and the test result proved that all of them are stationary in the three different specifications. Therefore, it can be conclude that all variables are integrated of order one. Therefore the first difference of all variables is used for estimation.

3.2. Multivariate Co Integration Test Results and VECM

A. Long run Equation for Growth Equation: Once the ADF unit root test result revealed that the series is I (1), a co integration test is performed to determine the rank of the co integrating vector. The rank of the co integrating vector is determined using the Johansen's maximum likelihood method.

Table 3.3. *Johansen's Co integration test results.*

Ho (null hyp.)	Ha(alternative hyp.)	Eingen Value	trace Stat	5% critical value	Prob.	max.	5% critical value	P. value
r = 0	r =1	0.822051	158.0928	125.6154	0.0001	63.87150	46.23142	0.0003
r ≤ 1	r =2	0.622206	94.22126	95.75366	0.0635	36.01601	40.07757	0.1337
r ≤ 2	r=3	0.576493	58.20525	69.81889	0.2946	31.78986	33.877687	0.0869
r ≤ 3	r=4	0.263501	26.41540	47.85613	0.8754	11.31634	27.58434	0.9567
r≤ 4	r=5	0.190987	15.09905	29.79707	0.7736	7.841785	21.13162	0.9131
r ≤ 5	r=6	0.141001	7.257268	15.49471	0.5479	5.623531	14.26460	0.6619
r ≤ 6	r=7	0.043194	1.633737	3.841466	0.2012	1.633737	3.841466	0.2012

Source; Eveiws 6 stastical output of johansen Co integration test.

The optimal lag length used to test for co integration is determined at lag length of one using Akakie Information Criteria (AIC).

The test result (both trace and max statistics) rejects the null hypothesis of no co integration both at the 5 % and 1 % significance level. In other words, the null of at most one co integrating vector is not rejected. Hence, there exists single co integrating vectors which make up the long run relationship among the variables in the system.

The presence of a single co integrating vector points to estimate the long run equation along with its associated coefficients (β) and adjustment parameters (α) which are important for further analysis. The corresponding β and α coefficient vector are reported below.

Table 3.4. *Normalized Long run β Coefficients.*

Variables	LnRGDP	LnAID	RFv	A^2	INVo	HC	LnLAB
Estimated coefficients	1.00000	-0.027	0.0047	0.00295	-0.014	-1.10e-10	-5.733

Source; Eveiws 6 stastical output of johansen Co integration test.

Table 3.5. *Adjustment (α) coefficients.*

Variables	LnRGDP	LnAID	RFv	A^2	INVo	HC	LnLAB
Adjustment coefficients	-0.725075	-5.135677	-0.66	-45451257	3.522394	-2.48e+09	-8.19e-05

Source; Eveiws 6 stastical output of johansen Co integration test.

Once after conducting co integration tests the next task would be identification of a given equation with specified endogenous and exogenous variables which is the main problem in most econometrics analysis. Therefore to identify variables that are endogenously determined and conditional up on the other variables in the VAR, the test for weak exogeneity is conducted. This requires imposition of zero restriction on the first column of α coefficient. The results of weak exogeneity test are given in the following table.

Table 3.6. *Result of weak exogeneity test (Zero restriction on α co-efficients).*

Variables	LnRGDP	LnAID	A^2	INVo	HC	RFv	LnLAB
α- coefficients	-0.725075	-5.135677	-45451257	3.522394	-2.48e+09	-0.66	-8.19e-05
2	20.51183	0.418486	0.900039	1.031968	0.3766521	1.71	0.030889
P-value	0.0006***	0.517693	0.341968	0.09697	0.539471	1.141	0.860489

Source; Eveiws 6 stastical output of imposing Zero restriction on α co-efficient. Note *** denotes rejection of the null hypothesis at 1% significance level.

The likelihood ratio test of exogenity indicates that except the dependent variable (real GDP) all variables are exogenously determined in the model. The null of weak exogeneity for the dependent variable is rejected at 1% level of significance while for other variables it is not rejected at any conventional level of significance.

Similarly a zero restriction is imposed on long run β coefficients to identify which explanatory variables constituting the growth equation are statistically different from zero.

Table 3.7. *Result of Zero restriction test on β coefficients.*

Variables	**LnAID**	**A^2**	**INVo**	**HC**	**RFv**	**LnLAB**
β-coefficients	-0.027	0.00295	-0.014	-1.10e-10	0.0047	-5.733
2	4.088618	4.175495	40.011	11.776	14.83	5. 07356
P-value	0.04636**	0.041013**	0.00000***	0.0006***	0.0000***	0.034728**

Source; Eveiws 6 stastical output of imposing Zero restriction on beta co-efficient. Note ***, **, represents rejection of the null hypothesis at 1%, 5% level of significance respectively.

The result of the likelihood ratio test (the zero restriction tests) performed on the long run coefficients of the explanatory variables shows the statistically significant coefficient different from zero, which allows the estimation of the long run growth equation. The estimated long run growth equation is:

$$LRGDP = 0.027LAID + 5.733LLAB - 0.00295A^2 + 0.014INVo - 0.0047RFv + 1.10e\text{-}10HC$$

[4.088618] [5.07356] [4.175495] [40.011] [14.83] [11.776]

(0.04636)** (0.034728) ** (0.041013) ** (0.000) *** (0.000) *** (0.0006) ***

Vector Hetero test: Chi^2(6) =11.37399(0.0775)

Vector AR (1, 2): Chi^2(30) =38.99056(0.1259)

Vector Normality: Chi^2(2) = 0.328147(0.848680)

The long run result depicts that all explanatory variables are significant in affecting growth at five percent level of significance.

The result of the diagnostic test confirms the adequacy of the model. That is, the null of homoscedacity is not rejected at any level of significant; therefore the model is free of hetroscedacity problem. In addition, the null of no serial correlation is not rejected and the test for normality confirmed that the errors are normally distributed and the null is not rejected at any conventional significance level.

Generally, aid has a significant and positive impact on the growth of a country. According to the result a one percent increase in aid will increase RGDP by 0.027 percent. This result is also consistent with the result reached by Tolessa (2001) and Tsegay (2008) in Ethiopia. Also Malik (2008) found that foreign aid has a long run positive impact on growth in Togo. The result also confirms that the impact of aid on growth is significant at 5% level of significant.

Like the theoretical expectation the Aid squared term, shows that negative and significant impact, suggests that the presence of capacity constraint in absorbing foreign aid beyond some level. In other words, the argument that foreign aid tends to have diminishing returns beyond some threshold level is operate in the Ethiopian situation in the study period considered since countries with low level of human capital and poor institutions are expected to have a capacity constraint in absorbing excessive capital from abroad and The existing situation in Ethiopia is a living example of the scenario. Similar result is obtained by Wondwossen (2003) for Ethiopia Lensink and White (2000) and Burnside and Dollar (1997, 2000) for Developing countries.

Deviation of rainfall from the long term mean has got a negative and significant effect on growth. The result indicates that fluctuation (irregularity) of rainfall has a deleterious influence on growth. This perhaps may be via its direct effect on the performance of agriculture in the long run since agriculture remained the dominant activity practiced at every corner of the country contributing nearly half of the GDP. In other words, the result points that whenever there is a climatic shock (rainfall shock); the effect is ultimately transmitted to the overall economy in the long run since agricultural production in Ethiopia is highly dictated by the availability of rainfall.

Thus the finding corroborates with the fact that rain-fed agriculture is not conducive for growth in Ethiopia.

Investment, which is not financed by aid, has a positive impact on growth. A unit change in investment which is not financed by aid to GDP ratio, leads to a 0.014 percent change in the real GDP of a country. The above result also confirms that its impact is significant at one percent level of significant.

Human capital has positive impact on the growth of a country. Referring to the result, a change in educational expenditure (a proxy to human capital) by one unit leads to a 1.1 percent change in the real GDP of a country and this result is significant at one percent level of significant.

The other variable which is entered on the long run growth equation is labor force in line with the theoretical expectation has entered with a positive sign and moreover it is significant. It shows that economically active labor force has played a role in promoting growth in the long run.

B. Vector Error Correction Model for Growth Equation

Since the variables in the growth equation are found to be co integrated, we proceed to estimate the vector error correction model which represents both the long run and short run adjustments among the variables. The lag changes in the relevant variables represent short run elasticity's (alternatively, short run variation), while the error correction term (ECT) represents the speed of adjustment back to the long run relationship among the variables. A VECM is estimated beginning with the general over parameterized model. Then the VECM is subjected to a systematic reduction and diagnostic testing process until an acceptable parsimonious model is obtained. In the process, all insignificant explanatory regressors with their corresponding lags are dropped until further reduction is rejected (Hendry, 1997).

In the short run dynamic equation, all weakly exogenous variables identified in the long run growth equation are entered in the right hand side of the model in their appropriate lagged difference form. In addition the error correction term with one period lag is also incorporated in the VECM. Using the VECM specification, a short run dynamic equation is estimated for growth function. Dropping insignificant regressors from the specification (i.e. step-by-step elimination of insignificant regressors from the general VECM model) following the general to specific modeling strategy, a parsimonious result for growth is reported below.

Table 3.8. *results of Short run equation for growth equation.*

Variables	Coefficient	t-value	p-value
D(INVO)	0.002031	0.544025	0.5912
ECT-1	-0.170086	-2.101302	0.0459**
D(ODA2)	9.82E-07	1.001502	0.3262
D(LNRGDP(-2))	0.361288	2.342078	0.0274**
D(LNODA(-2))	0.050126	1.249248	0.2231
D(HC(-2))	2.93E-12	0.207300	0.8375
D(ODA2(-1))	3.04E-06	.184942	0.0385**
D(LNLAB)	23.12110	5.762515	0.0000***
C	0.063514	5.638379	0.0000***

Note ***,** denotes that rejection of the null hypothesis at 1%,5% level of significance.
R^2 = 0.76 DW= 2. 03 F (10,36)= 74.83738(0.0000)
AR(1-2) =F(2,23)= 0.866839 (0.4336)
ARCH =F(1,33)= 0.317814 (0.5768)
Hetro=F(10,25)= 0.558932 (0.8350)
Normality =Ch^2(2)= 1.238561(0.427652)
Ramsey reset =F(1,24)= 1.290507 (0.2672)
Source; Eveiws 6 stastical output of vector error correction model.

The Goodness of fit of the model (R^2) shows, 76 percent of a variation in the dependent variable (RGDP) is explained by the variation in the explanatory variables included in the model.

The diagnostic test of the short run model for growth shows that there is no problem at all. The tests show that the null of the various tests are not rejected except for the joint insignificance of the explanatory variables i.e. the coefficients of the explanatory variables are jointly significant. The result shows that there is no serial correlation and the errors are normally distributed with constant variance. A test for ARCH is performed but the result failed to reject the null of no autoregressive conditional heteroscedasticity. The Ramsey test for model misspecification confirms that the model is well specified and there is no problem in the specification of the model.

The estimated dynamic equation for growth result indicates that foreign Aid (ODA) has a positive impact on growth as it is expected, however its impact is insignificant in the short run. It point that foreign aid was used to finance investment which has a longer gestation period and its impact may not be reflected in the short run.

Aid square has appositive and significant impact on growth. The finding reveals that unlike the theoretical expectation there is no capacity constraint in absorbing foreign aid at any level in the short run. In other words, the argument that foreign aid tends to have diminishing returns beyond some threshold level do not operate in the Ethiopian situation in the study period considered only in the short run.

Labor force in line with the theoretical expectation has entered with a positive sign and moreover it is significant. It shows that economically active labor force has played a role in promoting growth both in the short run and long run. Human capital proxed by education expenditure has appositive impact but it is insignificant in the short run.

The error correcting term is statistically significant and between zero and one. The coefficient indicates that RGDP adjusts itself to the equilibrium by 17 percent in one year.

3.3. Investment Equation

A. Long run Equation

Once all the variables entered the investment equation are integrated of similar order (I (1)), the next step is testing for co integration. The rank of the co integrating vector is determined using the Johansen's maximum likelihood method. The test result (both trace and max statistics) rejects the null hypothesis of no co integration both at the 5 % and 1 % significance level. In other words, the null of at most one co integrating vector is not rejected. Hence, there exists single co integrating vectors which make up the long run relationship among the variables in the system.

Table 3.9. *Johansen co integration test results.*

Ho (null hyp.)	Ha (alternative hyp.)	Eingen Value	Trace Stat	5% critical value	P-value.	max.	5% critical value	P-value
r = 0	r =1	0.727089	87.12206	69.81889	0.0011	48.04851	33.8768	0.0006
r ≤ 1	r =2	0.465527	39.07355	47.85613	0.2573	23.17957	27.58434	0.1659
r ≤ 2	r=3	0.241455	15.89398	29.79707	0.7197	10.22508	21.13162	0.7232
r ≤ 3	r=4	0.104526	5.668902	15.49471	0.7343	4.084891	14.26460	0.8503
r≤ 4	r=5	0.041908	1.584011	3.841466	0.2082	1.584011	3.841466	0.2082

Source; Eveiws 6 stastical output of Johansen Co integration test. The optimal lag length used to test for co integration is determined at lag length of one using Akakie Information Criteria (AIC).

The presence of a single co integrating vector points to estimate the long run equation along with its associated coefficients (β) and adjustment parameters (α) which are important for further analysis. The corresponding β and α coefficient vector are reported below.

Table 3.10. *Normalized Long run β Coefficients.*

Variables	LnINV	LnAID	LnDS	INF	LnS
Estimated coefficients	1.000000	-0.750	0.808	0.084	0.892

Source; Eveiws 6 stastical output of Johansen Co integration test.

Table 3.11. *Adjustment (α) coefficients.*

Variables	LnINV	LnAID	LnDS	INF	LnS
Adjustment coefficients	0.02881	-0.3969	-0.5655	-10.0375	-0.2286

Source; Eveiws 6 stastical output of johansen Co integration test

Once we identify β and α coefficient the next task is to identify variables that are endogenously determined and conditional up on the other variables in the VAR, the test for weak exogeneity is conducted. This requires imposition of zero restriction on the first column of α coefficient.

Table 3.12. *Result of weak exogeneity test (Zero restriction on α coefficients).*

Variables	LnINV	LnAID	LnDS	INF	LnS
α- coefficients	0.077	-1.063	-1.514	-26.873	-0.061
2	6.74	0.57	0.43	0.53	0.33
P-value	0.0094***	0.443	0.415	0.466	0.566

Source; Eveiws 6 stastical output of imposing Zero restriction on α co-efficient. Note ***, denotes rejection of the null hypothesis at 1% level of significance.

From the above table, the likelihood ratio test result indicates that except the dependent variable which is investment, none of the variables reject the null hypothesis that all the variables are weakly exogenous. Therefore investment is endogenously determined in the model while the other explanatory variables are weakly exogenous to the system. This enables us to analyze a single long run equation for investment conditional on the variables which are not endogenously determined in the model.

A zero restriction is also imposed on long run β coefficients to identify which explanatory variables constituting the investment equation are statistically different from zero.

Table 3.13. *Result of Zero restriction test on β coefficients.*

Variables	LnAID	LnDS	INF	LnS
β – coefficients	-0.750	0.808	0.084	0.892
2	13.11	9.84	24.27	5.15
P-value	0.0003***	0.002***	0.000***	0.023**

Source; Eveiws 6 stastical output of imposing Zero restriction on β co-efficient. Note ***, ** denotes rejection of the null hypothesis at 1%, 5% level of significance respectively.

Similarly, the zero restriction test performed on the long run coefficients of the explanatory variables shows that the statistically significant coefficient different from zero, which allows the estimation of the long run investment equation. The estimated long run investment equation is:

LINV = 0.750LAID - 0.808LDS - 0.084INF - 0.892LS

[13.11] [9.84] [24.27] [5.15]

(0.0003)*** (0.002) *** (0.000) *** (0.023) **

Vector Hetero test : Chi^2(4) = 1.275932(0.8654)

Vector AR(1,2): Chi^2(16) = 22.98631(0.1141)

Vector Normality: Chi^2(2) = 3.08773(0.213549)

As the statistics associated with the investment equation revealed all the explanatory variables are statistically significant i.e all the variables entered in the investment equation are significant in influencing investment and the diagnostic test for the model also reveals that the model fails to reject the null of no hetroscedacity, no serial correlation and the error terms are normally distribute at any level of significance.

According to the above result, foreign aid is found to have a positive and statistically significant influence on investment, i.e. a one percent increase in aid to GDP ratio leads to a 0. 75 percent increase in investment to GDP ratio. The result showed that foreign aid has played an important role in promoting domestic capital formation, and has been used effectively for financing domestic investment projects among other things. Also the result strengthened the main idea of the gap models in that foreign aid is used in capital scarce countries to bridge the resource gap. Therefore, it can be argued that for the period under consideration aid played a positive role in improving the level of investment by filling the saving-investment gap. A similar result was found by Tassew (2011), Tolessa (2001), Wondwossen (2003) for Ethiopia. Also a similar result has been found by Gomannee et al (2005) for sub Saharan African countries, and Hansen and Tarp (2000) in a cross country study. The result can be taken as an argument for the view that aid affects growth through its effect on investment.

The above equation also reveals a negative long run relationship between investment to GDP ratio and debt servicing to GDP ratio in the country. That is when a share of debt servicing of a country increases by 1 percent a share of investment reduces by 0.80 percent. This may be as result of government resource mobility to such servicing that could have been used for investment or a fear of high tax by private investors that reduces a countries investment.

Domestic saving also entered in the long run investment equation with a statistically significant and negative sign. The finding is not in line with the theoretical expectation and indicated that domestic capital has not served to promote investment in the country. It is commonly believed that since saving is a source of funding for investment, any policy that is designed to stimulate saving, will also stimulate investment. From the finding it is possible to argue that domestic capital (saving) has not been allocated for productive investment activities, and /or the poor development and policy of the financial sector has constrained saving from fostering investment.

On the other hand, the result may appear to indicate the fact that inflow of foreign capital retarded and created a downward pressure on domestic saving which diminishes the positive effect and leads to a negative relationship between saving and investment.

Inflation as an indicator of macroeconomic instability is also used in the long run analysis and the result showed that inflation deters investment significantly. That is, a one unit change in inflation deters investment by 0.084 percent. It suggests that an instable macroeconomic environment is not conducive for investment.

B. Vector Error Correction Model for Investment Equation

Since the variables constituting the investment equation are found to be co integrating, the next step is to estimate a vector error correction model for investment. Once the stationary of the variables and co integration test is conducted, based on the error correction term saved from the long run estimation the short run dynamics of the investment function is obtained as follows,

Table 3.14. *Results of short run equation for investment equation.*

Variables	Coefficient	t-value	p-value
D(LNODA)	0.280170	2.320953	0.0287**
D(LNS(-1))	-0.050169	-0.405959	0.6882
ECT(-1)	-0.431573	-2.590817	0.0158**
D(INF)	-0.006900	-2.919586	0.0073***
D(LNDS)	-0.161437	-1.891082	0.0703*
D(LNINV(-2))	0.432764	1.985699	0.0581*
D(LNDS(-2))	-0.035514	-0.292895	0.7720
D(INF(-1))	-0.001092	-0.452463	0.6548
D(LNS)	-0.055642	-0.530710	0.6003
D(LNODA(-1))	0.011529	0.392594	0.6979
C	0.005239	0.187771	0.8526

Note ***, **, * represents rejection of the null hypothesis at 1%, 5% and 10% level of significant respectively.
R^2 = 0.490696
DW =1.943339
F(10,36)=5.408659(0.0036)
Diagnostictests
Normality test = Chi^2(2) =0.865837(0.648613)
AR(1-2) = F(2,23) = 0.138121 (0.8717)
ARCH=F(2,31) =2.190232(0.1289)
Hetroscadasticity test F(10,25) == 0.810456 (0.6212)
Ramsey Rest test = F(1,24) = 0.259406 (0.6152)
Source; Eveiws 6 stastical output of vector error correction model.

The goodness of fit of the above models (R^2) shows that 49% of the total variation in the dependent variable (LINV) is explained by the independent variables in the model. The various diagnostic test of the model points no problem regarding the regression analysis. That is, there is no an indication of serial autocorrelation as shown by the Breusch Godfrey LM test for serial correlation. The Breusch-Pagan-Godfrey test for heterocedasticity also does not reject the null hypothesis of homocedasticity errors. Moreover, the ARCH test indicates that the absence of autoregressive conditional hetrocedasticity errors. Similarly, the general test for misspecification as provided by Ramsey's (1969) RESET test does not reject the null hypothesis of no functional misspecification in the estimated equations. And finally, the Jarque Bera test for normality indicates that the null hypothesis of normality distributed error terms is not rejected.

In addition, the reported F-statistics rejects the null hypothesis that the coefficients of all explanatory variables except the constant term are jointly zero. In general, no problem is detected by the diagnostic statistics of the model which provides support to the reasonableness of the specification.

The estimated coefficients of the VECM revealed that the signs of all variables except gross domestic saving are in line with the theoretical expectation. The result showed that investment is positively associated with foreign (aid) capital. In other words Foreign aid has positive and significant impact on investment at 5 % level of significance and its one period lagged also affects domestic investment positively but it is insignificant in the short run.

The estimated short run investment equation also shows that debt servicing has a negative and significant impact at 10 % levels of significant and its two lagged period also affects investment negatively but it is insignificant. This indicates that debt servicing seriously affects capital formation activity and its impact exists both to the long run and the short run (in both period its impact is negative and significant). The other variable used as a proxy for macroeconomic instability is inflation. The result revealed that inflation works against investment in the study period in Ethiopia. It has negative and significant impact at 1% level of significance on investment through discouraging entrepreneurs which works through the increment in the cost of production.

The other variable that was entered on the investment equation is that gross domestic saving unlike the theoretical expectation its contribution is negative but it is insignificant in the short run. As indicated above its long run effect is also negative and significant. However, the finding may call for further research to be investigated since gross domestic saving is considered to have positive impact on gross capital formation of particular country.

Finally, the coefficient of a lagged error correcting term is found to be negative and statistically significant. It points that 43.2 percent of the disequilibrium in the previous period is corrected in one year. In other words in one year the investment adjusts itself to the equilibrium by 43.2%.

4. Conclusion

The result from the growth equation revealed that aid contributed positively to economic growth in the long run, but its short run effect appeared insignificant indicating that most of the aid has been used to finance investment which has a long gestation period. Therefore, aid is effective in promoting growth in Ethiopia in the period considered.

Like the theoretical expectation the Aid squared term, shows that negative and significant impact, suggests that the presence of capacity constraint in absorbing foreign aid beyond some level only in the long run while in the short run the result indicates that no capacity constraint in absorbing foreign aid..

The empirical result on investment equation confirms that Aid has significant and positive contribution on investment both in long run and short run indicating Foreign aid used to finance the gap between saving and investment.

Therefore, for the period under consideration aid played a positive role in improving economic growth of Ethiopia through financing investment by filling saving investment gap.

Based on the empirical investigations, the following policy implications are drawn by the researcher that are recommended.

Foreign aid are composed of grants and loans, however the debt servicing associated with loan component of aid erodes the investment of a country which leads a larger loss in the present and future output of the country. Hence, external borrowing decision must be linked to a general policy frame work that will guarantee profitability of invested funds and generation of foreign exchange earnings for external debt servicing.

The result revealed that inflation works against investment in the study period in Ethiopia. Since inflation (higher rate) is taken as an indicator of a government that has lost control over the management of the economy, it is capable of transmitting a negative signal for investment.

Therefore, emphasis should be given to control inflation towards an acceptable level through the use of appropriate mix of fiscal and monetary policies. Such policies will have the tendency to minimize the unfavorable impact of inflation on entrepreneurs spending behavior and also benefit consumers to relieve the high cost of living associated with higher inflation.

The Ethiopia economy is characterized by low level of saving, therefore foreign aid can be used to finance this problem and enhance economic growth.

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