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FOREIGN AID AND ECONOMIC GROWTH IN ETHIOPIA[1]: A COINTEGRATION ANALYSIS

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Abstract

Poor countries lack sufficient domestic resources to finance investment and the foreign exchange to import capital goods and technology. The existing situation in Ethiopia is a living example of the scenario which binds economic growth. In this paper the unresolved question of aid effectiveness (usually measured by its impact on economic growth) in Ethiopia using a time series data covering the period 1970 to 2009 is addressed by employing multivariate cointegration technique. Foreign aid entered alone has a positive role in enhancing growth. However, the aid-policy interaction term has produced a significant negative effect on growth implying the deleterious impact of bad policies in constraining aid effectiveness. The overall effect of aid on economic growth over the period considered turns out to be negative due to lack of good policies. This paper indicates also that the country has no problem of capacity constraint as to the flow of foreign aid.

Keywords: Foreign aid, Economic growth, Policy, Cointegration, Ethiopia

JEL classification: F35, F43, E63, C32

1. Introduction

Foreign capital inflows are receiving due attention because of their potential to finance investment and perceived to promote economic growth in the recipient country. The growing divergence in saving and investment rates, export-import gap (foreign exchange constraints to import capital goods) and budget deficits in developing countries make them to depend highly on inflow of foreign capital. As Gomannee, Girma and Morrissey (2005) has aptly stated, "Poor countries lack sufficient domestic resources to finance investment and the foreign exchange to import capital goods and technology. Aid to finance investment can directly fill the savings-investment gap and, as it is in the form of hard currency, aid can indirectly fill the foreign exchange gap. As official aid is issued to government, it can also fund government spending and compensate for a small domestic tax base".

[1] An earlier version of this paper was prepared for presentation at the annual MSc thesis defense program held in Adama University, Ethiopia.

The scenario in Ethiopia is not different from the other poor countries. The capability of Ethiopia in improving the level of investment and promotion of economic growth through domestic capital sources and private capital inflow alone is far from adequate. This makes the importance of foreign aid indisputable to the performance of the economy.

There is still heated debate on whether or not foreign aid is effective in promoting economic growth in aid-recipient countries. There are strands on the aid-effectiveness literature where some claim that there emerges a consistent case for aid effectiveness (aid promotes economic growth); for instance, Hansen and Tarp (2000), Arndt, Jones and Tarp (2009) and Tarp (2009). Rather than looking at the unconditional average effect of aid, the recent literature has tried to establish that aid works under certain conditions only i.e. aid is effectiveness is conditional on policy environment, institutional factors, geographical location, etc.

The aid effectiveness literature is the most disgusting if one considers the region that has long been an important destination of aid-Africa., as most of the studies incline to conclude that aid is ineffective in Africa. An empirical investigation on the relationship between aid and growth by Gomannee, Girma and Morrissey (2005) on 25 sub-Saharan Africa countries from the period 1970 to 1997 show that aid appears to be ineffective. The study indicates, despite large aid inflows, SSA countries on average experienced only 0.6 per cent growth in real per capita GDP per annum over the period. On the face of it, this may appear to be a case of aid ineffectiveness. However, this does not imply that aid is ineffective in promoting growth at all. Similarly, Malik (2008) argued the significant negative effect of foreign aid on economic growth in sub-Saharan African (SSA) countries. He explains that for most SSA countries the more foreign aid they have received, the more aid dependent they have become. As growth faltered despite massive aid flows, foreign aid has bound them into a debt trap. His investigation on the six poorest African countries points the negative effect of aid in the five countries. The empirical result, estimated for each country, shows that in the five out of the six countries, foreign aid has a significant negative long run effect on economic growth, the only exception was Togo[2]. Foreign has a long run positive impact on growth only in Togo.

However, the negative impact of aid may not show the reality of aid ineffectiveness in those countries but rather the pitfalls in the model specification. The problem is that aid and investment are used together as explanatory variables which lead to the problem of double counting as part of foreign aid is used to finance investment.

While others argued for the conditional effectiveness of aid, for instance, Burnside and Dollar (1997) found that foreign aid is effective only in the presence of good macroeconomic policy environment; otherwise aid is ineffective. Other studies on aid effectiveness find that micro-based (project level) evaluations have found that in most cases 'aid works' (e.g. Cassen and associates, 1986), those at the macro level have yielded more ambiguous results, often failing to find significant growth effects. This conflict is what Mosley (1987) refers to as the 'micro-macro paradox'. Despite the massive literature on the subject, a consensus has not been reached on the growth impact of aid, rather the results are inconclusive. Thus one can find both success and failure stories.

[2] He considered the six poorest highly aid dependent African countries: Central African Republic, Malawi, Mali, Niger, Sierra Leone and Togo using Johansen's cointegration methodology.

The reasons for the inconclusive aid-growth link remain unclear but the econometric aid-growth literature has been criticized on several grounds: sample size and composition, data quality, econometric technique and model specification. A particularly telling criticism of most of these studies concerns the underlying model of growth, which is typically poorly specified.

In this paper the unresolved question of aid effectiveness (measured by its impact on economic growth) in Ethiopia using a time series data covering the period 1970 to 2009 is addressed. Besides other main determinants of economic growth in Ethiopia, factors that affect the effectiveness of foreign aid in enhancing growth are included. Specifically the role of macroeconomic policy variables, in line with Burnside and Dollar (1997), in determining aid effectiveness is examined.

As most of the aid-growth studies are dominated by panel regression techniques which inter mix countries of heterogeneous nature, country specific studies are relatively few in number and studies on the area are too scanty in Ethiopia. Specifically this paper tries to fill gaps and make contributions to the aid effectiveness literature in terms of the following issues:
Firstly, it supplements to the literature by investigating country-specific effectiveness of aid by taking Ethiopia as a specific case. Secondly, the scanty empirical studies on the growth impact of aid in Ethiopia remained weak in incorporating the recent advances in the aid-growth literature. To overcome such shortcomings a broader policy index which accounts both economic and infrastructure policy is constructed to test the conditional effectiveness of aid. Thirdly, the time series properties of the series are studied beforehand and the period analyzed is relatively long (40 years). Fourthly, to make statements on the relationship between aid and growth nexus over time, an analysis of the long-run relationship (equilibrium) between aid and other variables and real GDP is made.

To meet the aforementioned contribution to the literature the paper investigates the impact of foreign aid on economic growth in Ethiopia over the period 1970 to 2009, using a multivariate cointegration analysis. Since cointegration necessitates the variables to be integrated of the same order, the variables are tested for unit root and the result indicates that all the variables are stationary after first difference i.e. I(1). As a result, we run a test for cointegration and the result suffice the presence of long run relationship among the variables in the model. Existence of cointegration allows for the analysis of the short run dynamic model that identifies adjustment to the long run equilibrium relationship through the error correction model (ECM) representation. Hence a vector error correction model (VECM) is formulated.
The result indicates that aid contributes positively to economic growth in the long run when entered alone, but its short run effect appeared insignificant. In the contrary, when aid is interacted with policy, the growth impact of aid is negative implying the deleterious impact of bad policies on growth in the long run. Aid squared, unlike the theoretical view, has got a positive sign, pointing the absence of capacity constraint in the flow of aid to Ethiopia.

To summarize, the structure of the paper is as follows. Section 2 presents a review of literature on the aid-growth link, and an overview on the flow of aid to Ethiopia. Section 3 is devoted to the explanation of issues of model specification and empirical approaches used in analyzing the data.

We present empirical results and provide a discussion of issues related to the growth impact of aid in section 4. A final section of the paper is devoted to concluding remarks.

2. Literature Review

2.1. Aid and Economic Growth

The macroeconomic impact of foreign aid has long been a hotly contested subject. Aid's impact on growth in developing countries is arguably the most contested topic. It is also an important topic given its implications for poverty reduction, the other key criterion against which aid ought to be assessed. Despite massive flow of foreign aid to developing countries, economic growth and living condition which are assumed to be highly affected, among other things, by inflow of foreign aid remained low. McGillivray et al. (2005) state the unrealistically high optimism associated with foreign aid to developing countries in the early years of its provision.

Poor countries remained poor because the levels of investment were too low. This was due to low levels of domestic savings, insufficient amounts of foreign exchange required to purchase foreign capital goods or both. Foreign aid could fix this, by supplementing domestic savings or foreign exchange reserves. This would increase investment and in turn growth. However, such expectations were not materialized.

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. Durbarry, Gemmel and Greenway (1998) argued that 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.

Earlier macro, cross-country, econometric studies emphasized on the indirect effect of aid on economic growth through its effect on savings and then investment based on the Harrod-Domar growth model. They found a negative relationship between aid (often undifferentiated from other forms of foreign capital inflow) and GDP growth, and sought to explain it by aid reducing domestic savings or crowding out domestic savings (Griffin, 1970; Griffin and Enos, 1970; Weisskopf, 1972). Papanek (1972) argued that aid might well reduce domestic savings by increasing total income and consumption, but could still increase total savings and investment. He found a positive relationship between GDP growth and aid, but wide unexplained variations in aid effectiveness between countries.

The econometric methodology used in the earlier studies was modified by disaggregating foreign capital inflows into aid and other components, and focus on the impact of aid on investment and growth. The evidence, however, indicates that no overall consensus emerged regarding the impact of aid on investment i.e. it is not uncommon to find both pessimist and optimist view. For instance, Papanek (1973) and Levy (1988) support the positive association between aid and investment, whereas Boone (1996) and Easterly (1999) find the opposite result.

Hansen and Tarp (2000) surveyed 72 cross-country studies that have tested whether or not a direct impact of aid on growth can be identified over the past 30 years. They indicate that 40 show a

positive impact of aid on growth, while 31 show no statistically significant impact, and only one which indicated a direct harmful impact of aid on growth.

A fundamental argument for aid, at least on economic grounds, is that it contributes to economic growth in recipient countries. Morrissey (2001), Hansen and Tarp (2001), Easterly (2003), Easterly, Levine and Roodman (2004), and Pattillo et al. (2007) concentrate on studying the effectiveness of aid in terms of promoting real GDP growth in recipient countries and get mixed results. The famous results by Burnside and Dollar (2000) suggested that aid promoted growth only in an environment of 'good policies'. Following Burnside and Dollar, most of the research has focused on the importance (or lack of) of certain conditions in the recipient country. The "good policy" model, in which aid is effective, only when the recipient country government already pursues growth-promoting policies, has been very influential in shaping aid allocation procedures of major multilateral development agencies and bilateral donors.
Several researchers have tried to test the conditional effectiveness of aid on 'good policies' in response to the findings by Burnside and Dollar. Among the most important researches were those by Dalgaard and Hansen (2001), Hansen and Tarp (2001), Lensink and White (2001), Jensen and Paldam (2003) and Islam (2002). However, none of them fined a statistically significant aid-policy interaction.
Related research considers the effectiveness of aid to be dependent on certain features of recipient countries such as the share of a country's area that lies in the tropics (Dalgaard et al., 2004), institutional quality (Burnside and Dollar, 2004), political stability (Chauvet and Guillaumont, 2004, Islam, 2002), vulnerability to external shocks (Guillaumont and Chauvet, 2001) and absorptive capacity (Chauvet and Guillaumont, 2004). However, Easterly et al. (2004) and Rajan and Subramanian (2008) showed that the results were very fragile, being sensitive to small changes in the data set.

2.2. Overview of Foreign Aid to Ethiopia

The role of foreign aid in the economic development of a poor country such as Ethiopia is unquestionable. Foreign aid can be put to use in the economy where there exists a resource gap. The presence of a resource gap (saving-investment, fiscal and foreign exchange gap) forces the country to look outward for foreign capital in order to fill either of the gaps which are perceived to be the binding constraint for economic growth in the long run.

Foreign aid has played a major role in Ethiopia's development effort since the end of World War II. It has been instrumental in bridging the country's savings-investment and foreign exchange gaps. Its importance as a source of financing for the development of capacity building (human capital, administrative capacity, institutional building and policy reform) is also unquestionable. Thus increasing efforts were made to mobilize foreign aid in the last two regimes.
Dejene (1989)(cited by Fissiha, 2006) shows the importance of foreign aid in the development endeavor of the country where the majority of investment was financed by external capital. In Ethiopia, an inflow of external resources such as loans and grants has started in the mid of 1950, the

year in which the relationship between the United States and Ethiopia reached a higher level. For instance, pre 1975, about 75 % of the required total investment during the series of five year development plan periods (1957-1973) was covered by external capital. The magnitude of loans and grants that Ethiopia received in the years preceding the revolution was considerable. But due to the existing political- economic system it hardly contributed to economic progress. It was characterized by trifling development objectives. Similarly, during the post revolution period too, "37 percent of total investment expenditure of the annual campaign of 1979-1983" was financed by foreign aid.

The magnitude of aid flow to Ethiopia is not stable; it varies depending on the nature and characteristics of the political ideology, the economic system that the regime follows, and the relationship with donor countries and institutions. In deed such uncertainty and instability in the flow of aid makes long term development planning difficult. During the socialist regime (1975-1990), Ethiopia had been receiving development assistance from Eastern Block donors particularly from the Soviet Union and East Germany, as well as from Western bilateral and multilateral donors to some extent. In the Derg regime (1974/75-1990/91) the country received Birr 1.1 billion on average terms per year. The average share of aid (ODA) in the GDP was 4.8 percent in the same period.

Comparatively the total flow of foreign aid has increased in the post 1991 period due to changes in policies which meet the interests of donors, and adoption of a market-oriented economic system. Since the policy change by the present regime the magnitude of development aid (both loan and grant) has increased continuously. In this period (1991/92-2008/09) average annual flow of aid has reached to Birr 10.8 billion and its share in the GDP also rose to 13 percent from a 4.8 percent in the Derg period. The period 1996/97-2000/01 witnessed a decline in aid which was below the average share of the GDP, the lowest share of 7 percent being observed in 1997/98. The major factor for the decline in the specified period was the war with Eritrea where the majority of donors were denying the war. Despite the huge flow many claim that aid to Ethiopia is ineffective in bringing about the desired changes, for instance, in terms of poverty reduction and enhancing economic progress. But this does not imply that aid is totally wasted (or, aid is ineffective at all) because there are some improvements in the social indicators like enhancing access to education and health services.

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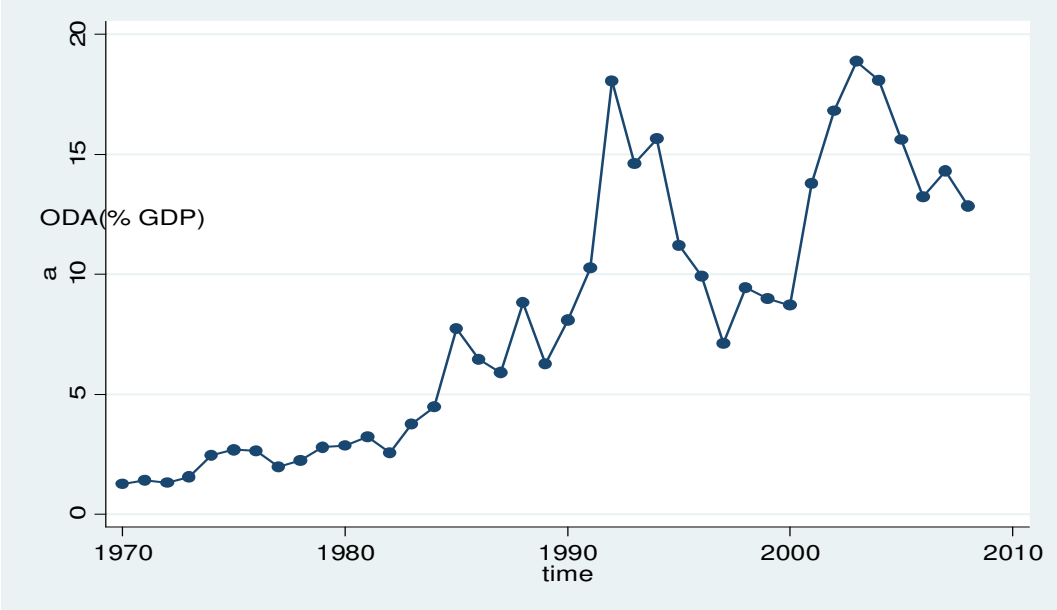
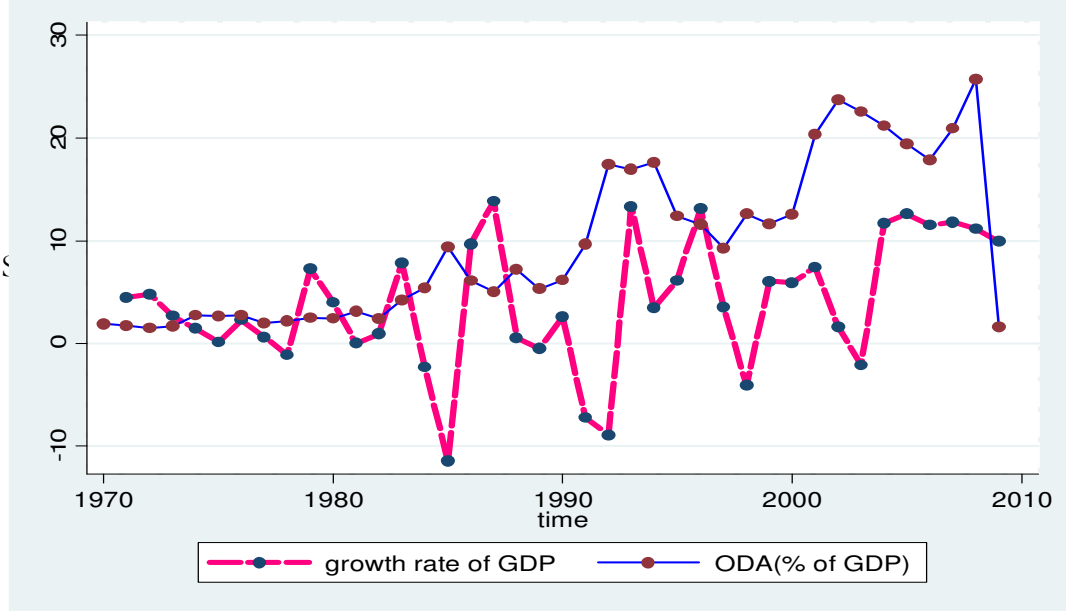


Source: author's computation based on data from IMF's database

Figure1 - Flow of aid (as a share of GDP) to Ethiopia (1970-2009)



Source: author's computation based on data from IMF's database

Figure 2 - Real GDP Growth relative to share of ODA (1970-2009)

No clear cut statement can be made from Table 1 and Figure 1 as their movement is not consistent throughout the period considered; for instance, before 1990 both growth rate of the economy and flow of aid were lower.

Table1 - Flow of aid (ODA) to Ethiopia

Periods	ODA as share of GDP	Growth rate of GDP
1970-1980	2.1	2.7
1981-1990	5	2.23
1991-2000	12.5	2.8
2001-2009	18.6	8.2

Source: author's computation based on IMF's database

The lower growth rate can't be entirely explained by the volume of aid flow to the country rather there are a number of factors at work; as a relative increase in the flow of aid in the period 1981-1990 was not coupled by a similar growth in the GDP. The salient feature on the movement between the variables, however, is in the post 1990 period where the boost in the flow of aid is matched relatively by a better growth, especially after 2001.

3. Methodology and Data

3.1. Model Specification

The method employed in the study is based on recent advancements in the theoretical and empirical aid-growth relationships. Various time series tests are performed such as unit root test and cointegration test. Thus Augmented Dickey-Fuller test (ADF) is applied to test the stationarity of the series, and Johansen's maximum likelihood procedure is used to determine the rank of cointegration vector.

Our empirical exercise is composed of three parts. The first part tests for the presence of unit root for each variable using the Augmented Dickey-Fuller test. The second step is finding out the number of cointegrating vectors in the system using Johansen's (1988) cointegration tests and finding the long run equilibrium growth equation, and finally the vector error correction model (VECM) is estimated. The optimal lag length for Johansen's cointegration test is determined by applying Akaike Information Criterion (AIC). Stata10 statistical software econometric package is used for estimation.

The model for estimation is specified in log-linear form as:

$$lY_t = a_0 + a_1 lI_{OAt} + a_2 lA_t + a_3 PA_t + a_4 A_t^2 + a_5 lL_t + a_6 RFV_t + U_t , \qquad (1)$$

where, Y is the level of real GDP, I_{OA} is non aid financed investment[3], A is official development assistance, PA is policy-aid interaction term, A^2 is aid-squared: all stated as percentage of GDP, L is active labor force (15-64 years) as percentage of total population, RFV represents deviation of actual rainfall from the normal trend[4], and α_0 is the constant term α_1, α_2 ,α_5 and α_6 are elasticity coefficients, α_3 and α_4 are slope coefficients, and U_t is the white noise error term.

Descriptions of variables used in the model specification above are explained as follows:
(i) Y: the level of real GDP;
(ii) I_{OA}: the ratio of non-aid financed investment to GDP. The variable I_{OA} is developed by using the technique of generated regressor as follows. 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 (I_{OA}). Then I_{OA} 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 (I_{OA}) is generated as:

$$I_{OA}=I-0.58A \qquad (2)$$

(iii) A: 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 %.
(iv) PA: an interaction between policy index *(P)* and aid *(A)* which capture the conditional effectiveness of aid on policy. The policy index is developed based on Burnside and Dollar (1997), with minor modifications, out of a regression result obtained from a growth equation. The growth model is comprised of budget surplus/deficit, openness to trade, credit access to the private sector, and telephone lines per 1000 people (covering aspects of fiscal, trade, monetary, and infrastructure policy) as an explanatory variable, and the coefficients of these variables are taken from the growth regression to construct the policy index. To account for openness to trade in the construction of the policy index *(OPEN)*, a standard openness index, $(X + M)/GDP$ is used. Since the policy index constructed earlier are criticized for their narrowness in scope and failed to encompass a wider perspective of the economy, the policy index is augmented by telephone lines per 1000 people as a proxy for infrastructure policy. The result of the policy index obtained is:

[3] The result for non aid finance investment is provided in Appendix.
[4] RFV is deviation of actual rainfall from the long term mean where the long term mean annual rainfall is 930ml.

$$P_t=10.98-0.067(BD)_t+0.81(OPEN)_t+0.44(CR)_t+0.55(TELE)_t \quad (3)$$

BS/BD: overall budget surplus/deficit excluding grants;
CR: credit access to the private sector-total amount of credit given to the private sector. Unlike the Burnside-Dollar (1997) approach which used inflation as a proxy for monetary policy, this paper instead used financial liberalization to the construction of policy index measured by credit access to the private sector. This is made with the belief that more access to credit to the private sector is a positive factor in motivating investment and growth. Inflation is excluded from the construction of the policy index because prices remained in control for a long period of time through regulation and as a result it may not reflect the true success or failure of monetary policy in Ethiopia.
X: total value of goods and services exported;
M: total value of goods and services imported;
TELE: major telephone lines per 1000 people.
(v) 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.
(vi) L: labor force (age from 15-64 years) as a percent of total population;
(vii) 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 $(RFV)=RF_t-\overline{RF}$, RF_t - annual rainfall at period t, and $\overline{RF}$ - the mean average rainfall.
(viii) D_{74} and D_{91}: dummy variables for major political changes (Derg and EPRDF) taken in to account to see the effect of major shifts in political environment on the performance of economic growth in the short run. The dummies are incorporated in to the VECM model for growth equation. For this reason, a dummy variable D_{74} (to capture the impact of major political change from the Imperial regime to Derg) and D_{91} (to capture the impact of major political shift from the Derg to EPRDF) is incorporated in the vector error correction model (VECM) to indicate the immediate impact of major political changes on economic growth. Thus D_{74} took a value of 1 for the year 1974 and 0 otherwise. Similarly, D_{91} took 1 for 1991 and 0 otherwise. Since it was not common to transfer political power in a peaceful manner in Ethiopia, political unrest and violence resulted consequently and the two dummies are used for this purpose to reflect the immediate impact of such changes on growth.

3.2. Data source

The data were collected from various sources such as National Bank of Ethiopia (NBE), Central Statistical Authority (CSA), Ministry of Finance and Economic Development (MoFED), Ethiopian Economic Association (EEA), National Metrology Agency and International Monetary Fund's (IMF) database.

3.3. Empirical Methodology and Results

3.3.1. Unit Root test

Since unit root tests are sensitive to the presence of deterministic regressors, three models are estimated. The most general model with a drift and time trend is estimated first and restrictive models i.e. with a constant 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 ADF test results show that all the variables (in levels) are non stationary with the three different specifications. Furthermore, the first differences of the variables are investigated for a unit root and the test result proved that all of them are stationary. Therefore, we could conclude that all variables are integrated of order one.

Table 2 - ADF Unit Root Test Results

Variables (in levels)		C&T	C	NCT
lA		-1.703	-1.511	-0.139
lY		0.144	2.209	2.479
lI_{NA}		-2.285	-1.006	0.734
A2		0.774	2.611	0.003
PA		-3.6	-0.583	0.602
lLF		-2.463	0.056	-1.512
RFV		-3.187	-3.09	-2.484
lA		-3.238	-0.985	-1.879
P		2.766	2.962	2.13
Critical values	*1%*	*-4.27*	*-3.668*	*-2.641*
	5%	-3.552	-2.966	-1.95

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Table 3 - ADF Unit Root Test Results (variables in first difference)

Variables in first difference		C&T	C	NCT
DlY		-5	-3.781	-2.643
DlI_{NA}		-4.366	-4.359	-4.246
DA2		-4.811	-4.01	-3.606
DPA		-4.323	-4.298	-4.011
DlLF		-3.597	-3.93	-2.69
DRFV		-5.547	-5.621	-5.695
DlA		-4.491	-4.538	-4.077
Critical values	*1%*	*-4.27*	*-3.668*	*-2.641*
	5%	-3.552	-2.966	-1.95

Note: D represents the first difference of the time series variables. C&T represent for both constant and neither trend, C for constant no trend, and NCT stands for neither constant nor trend is included in the model.

3.3.2. Multivariate cointegration test result

To conduct a test for co-integration in a multivariate framework using Johansen's maximum likelihood procedure, first the general VAR (Vector Autoregressive) model of relationship between the variables should have to be formulated. Thus a general VAR (p) of the following form is formulated:

$$X_t = \Phi_1 X_{t-1} + \Phi_2 X_{t-2} + \ldots + \Phi_p X_{t-p} + \Psi W_t + \varepsilon_t, \quad (4)$$

where X_t is a (mx1) vector of stochastic I(1) variables, W_t is a (qx1) vector of deterministic variables (for instance trend and dummy variables), and each Φ_i $(i=1\ldots.p)$ and Ψ are (mxm) and (mxq) matrices of parameters. ε_t is a a (mx1) vector of normally and independently distributed disturbances with zero mean and non-diagonal covariance matrix(vector of white noise disturbance terms), and $t=1\ldots.T$ (T is the number of observation).

Providing the variables are (at most) integrated of order one i.e. I(1) and co-integrated also has an equilibrium error correction representation that is observationally equivalent but which facilitates estimation and hypothesis testing, as all terms are stationary. The vector error correction model (VECM) is:

$$\Delta X_t = \pi X_{t-p} + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \ldots + \Gamma_{p-1} \Delta X_{t-p-1} + \Psi W_t + \varepsilon_t. \quad (5)$$

Simplifying equation (5) gives

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \pi X_{t-p} + \psi W_t + \varepsilon_t \quad (6)$$

where $i=1\ldots..p-1$, $\Gamma_i = -[I - \sum_{j=i+1}^{p} \Phi_j]$, and $\pi = -[I - \sum_{j=1}^{p} \Phi_j]$.

The long run relationship among the variables is captured by the term πX_{t-p}. The Γ_i coefficients estimate the short run effects of shocks on ΔX_t and thereby allow the short and long run responses to differ. In the Johansen (1988) procedure, determining the rank of π (i.e. the maximum number of linearly independent stationary columns in π) provides the number of co-integrating vector between the elements in x. In this connection, there are three cases worth mentioning. (i) If the rank of π is zero it points that the matrix is null which means that the variables are not co-integrated. In such case the above model is used in first difference, with no long run information, (ii) If the rank of π equals the number of variables in the system (say n) then π has full rank which implies that the vector process is stationary. Therefore the VAR can be tested in levels, (iii) If π has a reduced rank- i.e. $1<r(\pi)<n$ it suggests that there exists $r<(n-1)$ co-integrating vector where r is the number of cointegration in the system. The matrix π is given by ($\pi=\alpha\beta^1$), where β coefficients show the long run relationship between the variables in the system(cointegration parameters) and α coefficients show the amount of changes in the variables to bring the system back to equilibrium i.e. it shows the speed with which disequilibrium from the long run path is adjusted. To identify the number of cointegrating vectors, the Johansen procedure provides n eigenvalues (λ) - characteristic roots whose magnitude measures the degree of correlation of the cointegration relations with the stationary elements in the model.

Two test statistics (λ_{trace} and λ_{max}) are used to test the number of cointegrating vectors, based on the characteristic roots. The statistics are calculated from the following formula:

$$\lambda_{trace} = -T\sum_{i=r+1}^{n} ln(1-\hat{\lambda}_i), \; r=0,1,\ldots n-1, \qquad (7)$$

$$\lambda_{max} = -Tln(1-\hat{\lambda}_{r+1}), \qquad (8)$$

where T is the sample size, and $\hat{\lambda}_i$ is the estimated eigen values.
λ trace tests the null that the number of cointegrating vectors is less than or equal to r against an alternative of $(r+1)$. The λmax statistics, on the other hand, tests the null that the number of cointegrating vectors is r against an alternative of $(r+1)$. The distribution of both test statistics follows chi-square distribution.

Since all the variables are non stationary, a regression analysis using ordinary least squares (OLS) may produce spurious results. However, all of the series are stationary after first differencing and can be used in regression analysis. Mallik (2008) explains the drawback of this method that is the possibility of losing long-run information present in the variables. Such problems can be overcome by applying cointegration technique, which shows the long-run relationship among the non stationary series. The rank of the cointegrating vector is determined using Johansen's maximum likelihood technique. The test result is presented below (Table 3).

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Table 4 - Johansen cointegration Test

Ho (null hyp.)	Ha (alt.hyp)	Eigen value	λ trace stat.	5 % critical value	1% crit. value	λ max	5 % crit. value	1% crit. value
r=0	r=1	0.8355	162.48***	124.24	133.57	68.58***	45.28	51.57
r≤1	r=2	0.64255	98.899	94.15	103.18	39.09	39.37	45.1
r≤2	r=3	0.3799	54.8	68.52	76.07	18.16	33.46	38.77
r≤3	r=4	0.34841	36.64	47.21	54.46	16.27	22.07	32.24
r≤4	r=5	0.24054	20.3677	29.68	35.65	10.45	20.97	25.52
r≤5	r=6	0.21983	9.912	15.41	20.04	9.43	14.07	18.63
r≤6	r=7	0.01252	0.4789	3.76	6.65	0.4789	3.76	6.65

Note: *** denotes rejection of the null hypothesis at 1 % significance level respectively.

There is only one long run relation describing the output growth-equilibrium relationship with the variables in the system. Consequently, we assume one cointegrating relationships for further analysis and an equation with one stationary relationship in the model is estimated. The estimated long run growth equation is:

$$lY = \underset{(2.5)}{0.036lI_{NA}} + \underset{(25.57)\ ***}{2.74e\text{-}10A^2} - \underset{(24.78)\ ***}{0.678\ PA} + \underset{(23.55)\ ***}{2.35\ lLF} - \underset{(14.83)\ ***}{0.0047RFV} + \underset{(22.93)\ ***}{0.436lA} \qquad (9)$$

The contribution of foreign aid is positive[5] and significant i.e. the long run elasticity of growth with respect to aid is 0.45. The result in general points that aid support growth in Ethiopia. The main mechanism can be either through financing investment or by increasing worker productivity (for instance, through investments in health and education). Aid also supports growth through facilitating the import of new technology or knowledge. The result is supported by other studies Tarp (2009) and Arndt, Jones and Tarp (2009) who argued that aid has an average positive effect on growth. Also Malik (2008) find that foreign has a long run positive impact on growth in Togo. In addition, a supporting result was found by Tolessa (2001)[6] for Ethiopia.

In contrary, foreign aid interacted with policy (PA) has a significant negative influence on growth[7]. The negative result is associated with the policy environment (macroeconomic and infrastructure) in the country which makes aid less effective than otherwise would be. A comparison of the coefficients of aid and the aid interacted with policy index in absolute terms indicate that aid would be more effective had there been a favorable macroeconomic policy environment. Though the

[5] The positive impact of aid result must be interpreted with caution as it turns out to be negative when conditioned on the policy environment i.e. due to poor policy environment the overall effect of aid on growth is negative.
[6] Tolessa A (2001), The Impact of Foreign Aid on Domestic Saving, Investment and Economic Growth: The Case of Ethiopia, Unpublished M.Sc Thesis, AAU.
[7] The negative impact of PA may appear to point that aid cause's policy for bad in the period considered. Such negative causation can be linked with the dependency syndrome that aid creates on the country: The existence of aid to finance imports might reduce the need of economies to liberalize their trade regimes more to encourage exports, and similarly, donors support may increase poor countries' access to capital markets and result in larger borrowings and deficit.

importance of a sound policy environment for growth is not questionable, but the argument of Burnside and Dollar (1997, 2000) that aid is effective only in a good policy environment is not totally valid in Ethiopia. Rather it can be argued that aid is effective in promoting growth in Ethiopia in the period considered; but its effectiveness is diminished as it was not supported by a sound macroeconomic policy environment. Even though the policy environment is bad, aid entered alone has a positive contribution to growth as indicated above. This result seems to corroborate with the idea that "aid is generally effective even in bad environment" as argued by Dalgaard, Hansen and Tarp (2004).

However, what is inherent in the result is that aid tends to be contributing negatively to growth due to unfavorable policy environment. Furthermore, since the negative coefficient on the PA term outweighs the positive coefficient on aid entered alone the implication of the overall result is that aid works against economic growth in Ethiopia for the period considered in general.

Unlike the theoretical expectation the squared aid term that was used to detect the presence of capacity constraint, has significant effect on economic growth. The result suggests that there is no capacity constraint in absorbing foreign aid at any level. 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. Furthermore, the finding may point the huge capital requirement to meet the wide spread development need of the country and the importance of increasing foreign aid flow to promote growth. But the coefficient is too small as given by the long run growth equation. Lensink and White (2001) find some evidence for negative returns to aid at high levels of aid inflows. However, they added that the results are sensitive to the countries considered as well as the exact specification. However, the finding may call for further research to be investigated since countries with low level of human capital and poor institutions are expected to have a capacity constraint in absorbing excessive capital from abroad.
The long run growth result shows that all the variables (except non-aid financed investment) reject the null at 1% significance level. That is investment which is not financed by aid has insignificant effect on growth. The role of domestic capital formation in enhancing growth in the study period was weak at best, which points the inefficiency associated with capital formation activity.

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.
Labor force in line with the theoretical expectation has entered with a positive sign which shows that economically active labor force has played a role in promoting growth in the long run.

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3.3.3. Vector Error Correction Model

Existence of cointegration allows for the analysis of the short run dynamic model that identifies adjustment to the long run equilibrium relationship through the error correction model (ECM) representation. As one long run cointegrating vector is determined, the VECM is formulated as follows:

$$\Delta lY = \sum_{i=1}^{2} \Delta lY + \sum_{i=0}^{2} \Delta lINA + \sum_{i=0}^{2} \Delta A^2 + \sum_{i=0}^{2} \Delta lPA + \sum_{i=0}^{2} \Delta lLF + \sum_{i=0}^{2} \Delta RFV + \sum_{i=0}^{2} \Delta lA + ECT_{t-1} + D, \quad (10)$$

where lag length of two is determined by Akaike Information Criterion, D and ECT represent a dummy for major political changes and error correction term respectively.
Since the variables constituting the growth equation are found to be cointegrating, the next step is to estimate a vector error correction model for growth.

Table 5 - Result for Dynamic Growth Equation

Variable	Coefficient	t-value
Constant	6.02**	2.55
DlA_1	0.0039	1.13
DPA	-0.152***	-3.8
DA^2	6.43E-11***	3.4
DA^2_1	-4.24E-11*	-1.91
DRFV	-0.0063	-1.00
D91	-0.095**	-2.06
ECT_1	-0.45**	-2.54
Note: ***, **, and* denotes significance at 1 %,5 % and 10 % respectively. The optimal lag length is determined at lag length of two using Akakie Information Criteria (AIC). *R^2=0.5166* *F(7,30)= 4.58 [0.0014]**** *Diagnostic Tests* *DW =1.91* *ARCH(1,2) test: Chi2(2)= 0.370[0.8309]* *AR(1,2) test :F(2,28)=0.263[0.7708]* *Hettest: F(1,36)=0.00[0.948]* *Normality test: Chi2(2)=1.74[0.418]* *RESET test: F(18,12)=0.95[0.5487)*		

The independent variables explain nearly 52 percent of the change in dynamic model. In addition various diagnostic tests are performed; all the tests confirmed that the model is well specified and the regression analysis is adequate. The diagnostic 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 autoregressive conditional heteroskedasticity is performed but the result failed to reject. 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 official development assistance has insignificant effect on growth. The finding point that foreign aid is used to finance investment which has a longer gestation period and its impact may not be reflected in the short run. The aid-policy interaction term has got a significant and negative influence on growth. It indicates the unfavorable role of poor policies for growth. Furthermore, the result revealed that bad economic policies remained a challenge for economic progress both in the short run and long run.

Aid squared has produced inconclusive and mixed result in the short run. Current aid squared has produced a result which is in line with the long run equation implying that there is no capacity constraint while the one year lagged difference aid squared support the view that aid has a diminishing return beyond some level and hence capacity constraint in the absorption of aid flow though marginally at 10 percent significance level.. Though it is not statistically significant, rainfall variability does have a negative impact on growth. The Dummy for major political change in the country from the Derg (1974-1991) to EPRDF (1992-to present) (D91) has an immediate negative impact on growth. However, the long run effects of such change are not analyzed since the objective was to identify the immediate short run effect of political unrest. In addition, as there was no peaceful transfer of power from the Imperial regime to Derg (D74) and from the Derg to EPRDF (D91), the country experienced a political upheaval. Thus the result captures the influence of such political instability on growth in the short run. However, the coefficient of major shifts in government from the Imperial to Derg regime is not statistically significant even though it has a positive sign. The error correcting term is statistically significant. The coefficient indicates that 45 percent of the disequilibrium in the previous period is corrected in one year. Thus it takes slightly above two year for the deviation adjusts fully to the long run path.

4. Conclusion and Policy Implications

Previous studies have already discussed the effectiveness of foreign aid on economic growth but the results are somewhat inconclusive, due to the short time period considered or the failure to study country-specific cases. Taking a relatively longer time series data (1970 to 2009), the growth impact of aid is examined for Ethiopia using Johansen's multivariate cointegration technique. Moreover, the paper discriminates the short- and long-run impacts of foreign aid, among other variables, on economic growth.

The result reveals that aid contributes positively to economic growth in the long run when entered alone but its short run effect appeared insignificant. In the contrary, when aid is interacted with policy, the growth impact of aid is negative implying the deleterious impact of bad policies on growth in the long run. The overall finding implication is that the growth impact of aid is negative due to the presence of poor policy environment in the country. Aid squared, unlike the theoretical view, has got a positive sign, pointing the absence of capacity constraint in the flow of aid to Ethiopia.

In addition, rainfall variation (alternatively, rain-fed agriculture) has unfavorable contribution to growth. Non-aid financed investment is also entered in the growth equation to avoid the problem of double counting but its impact on growth is insignificant.

Though the view that aid is ineffective but only in a good policy environment is not fully supported by this study, the finding points the importance of a good policy environment to make aid more effective. In other words, the negative impact of the aid-policy interaction on growth indicates the role that inefficient policies can play in diminishing the positive effect of aid on growth. Thus setting a sound policy environment is crucial to use aid more effectively and make domestic investment efficient. Furthermore, the policy index constructed implies that emphasis should be given not only to economic policy setting but to sound infrastructure policies are also crucial for growth.

The overall result shows the importance of increasing foreign aid flows to Ethiopia, despite contributing less due to unfavorable policies, to enhance investment and growth. However, in the long run, rather than merely filling gaps, aid should help close gaps in Ethiopia, since reliance on future aid and foreign borrowing is thus diminished.

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Appendix

1. Since aid finances investment, including both aid and investment together in the estimation of the growth equation may lead to the problem of double counting. Such problems are solved by the technique of residual generated regressor i.e. investment which is not financed by aid is generated from an investment regression where aid is used as the only explanatory variable. Thus non-aid financed investment is generated as follows:

I_{NA}=*INVESTMENT-0.58AID*

2. The policy index was constructed as a weighted sum of budget deficit, openness and credit access to the private sector to capture fiscal, trade and monetary policy. Although this index provides a good idea of a country's policy stance, we believe that it is not broad enough for a typical developing country like Ethiopia. Therefore, the policy index was augmented by major telephone lines per 1000 people (TELE) and is relatively broad. TELE is used as indicator (proxy) for infrastructure policy.
The result obtained from the growth regression which is used in the construction of the policy index is presented as a weighted sum of openness, credit access to the private sector, budget deficit and TELE as follows:

LY=10.98+.81OPENNESS-0.063BUDGETDEFICIT+.44CREDIT+ 0.55TELE