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CAPITAL INFLOW NEXUS GROWTH IN ETHIOPIA: EVIDANCE FROM ARDL, ECM TESTING APPROACH.

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ABSTRACT

The effect of capital inflow on economic growth has become a debating macro-economic agenda among scholars & policymakers in Africa particularly in Ethiopia. From this ground, the researcher has tried to examine The Effect of Capital Inflow on Economic Growth of Ethiopia using an Auto Regressive Distributed Lag Bound Testing Approach (1990 to 2019). The result of the analysis revealed that the Long-run and short-run impact of official inflow (remittance, foreign aid and foreign direct investment) are positive at 1%, 5% and 1% significant level respectively. The long run & short run effect of external debt but reveals negative and significant at 5% and 1%. Other variables of growth such as gross capital formation appeared to be positive and significant at 1% in long run and short run while terms of trade and unemployment rate were significant and negatively associated to growth in both long run and short run growth. The error correction model result shows that, the previous year's error will be corrected in the current period at an adjustment speed of 90% which takes about 1.1 years to converge to its long-run static position after the short-run shocks. The researcher recommends the concerned body for better benefits of foreign capital flow, the government of Ethiopia has to play a significant role in ensuring better institutional policy arrangement and sound macroeconomic policies, which are necessary requirements and the transmission of remittance channeling into formal which is used to control black market and to fill saving investment gap.

Key Words*: ARDL, Capital inflow, Economic Growth, ECM, Ethiopia.*

JEL classification: B41, C22, F32, F62, O55

1. Introduction

The need for external capital by developing countries to supplement domestic savings for investment and growth has existed for decades. This is as a result of the gap between domestic savings and domestic investment, in terms of which countries require other sources of capital outside the domestic economy to sustain economic growth. It is widely acknowledged that most African countries in general and Ethiopia in particular are faced with resource gap constraint. This is a status quo in which the accessible capital to sustenance healthy economic growth and development falls short of the quantity required. This constraint has limited governments' ability to exercise its core function of securing lives and properties on one hand and improving the social welfare of its citizens on the other hand (Raheem & Adeniyi, 2015).

It has become pertinent for governments to evolve feasible alternatives for plugging this resource gap as it particularly has undeniable implications for government stability. Consequent upon the foregoing, African governments have at different times resorted to seeking external funds among which are foreign direct investment (FDI), official development assistance (ODA), remittances and external debt. These flows are

viewed as available options for solving the problem of resource/funding inadequacy (Raheem and Ogebe, 2014).

In developing countries, capital inflows are becoming increasingly important particularly in their early development process to enhance their economies. This is because the domestic financial market and financial sources are not sufficient to finance the existing and increasing demand for different development programs and projects (Sawalha et al., 2016). Similarly, international capital can supplement domestic resources in developing economies, in view of the growing mismatch needs between their capital stock and capital requirements (Orji et al., 2014).

The need for external finance is epitomized in developing countries especially in Africa where there is high level of poverty. In a situation where there is hardly enough money for consumption, as in the case of most countries in sub-Saharan Africa (SSA), it becomes increasingly difficult to save. In addition, the advent of democratic regimes in Africa in the last few decades have seen countries pushing for globalization. In recognition of the need to attract foreign capital, most developing countries in the global context have liberalized their external account to encourage capital inflows. Accordingly, in SSA many countries also liberalized their capital accounts in the last two decades, especially around the 1990s, to encourage the inflow of foreign capital into their economies. Inflows of capital are generally expected to stimulate and promote economic growth (Adeniyi *et al*, 2015).

1.2 Statement of the Problem

The decisive goal of any country is to realize sustainable economic development. But economies of least developed countries (LDCs) are characterized by balance of payment deficits, which arise from the general structure of the economy as well as international economic relations (Ramzan & Ahmad, 2014). This is because LDCs are dependent on the primary production for their foreign exchange requirements. Moreover, when saving is considered, the rate of saving in LDCs is not sufficient enough to finance the necessary level of investment. So, it has been very difficult to get in to what is known as sustainable economic growth and development (Mohapatra *et al.*, 2016).

Though capital inflow has its own importance in some aspects, it is in question that whether capital inflow assists generally LDCs and particularly that of Ethiopia in accelerating economic growth by positively affecting saving-investment gap in the country. The country is surrounded by multidimensional problems that challenge to sustain the current trend of economic growth. Ethiopia, being one of the less developed countries in the world and characterized by low level of saving and low investment activities that negatively affect economic growth in the country. Therefore, to fill the saving and investment gap that helps to achieve sustainable growth and development the country is in need of foreign capital from developed countries; aid (Tasew, 2011; Siraj, 2012; Fentaye, 2015), FDI (Selamawit, 2015), remittances (Ghosal, 2015) and external debt (Kassa, 2014; Mulugeta, 2014).

The most important permanent feature of the Ethiopian economy is the presence of resource (financial) gap. The resource gap can be best described as the existence of savings-investment gap, fiscal gap and foreign exchange gap. The presence of these resource gap forces the country to rely on an inflow of foreign finance to bridge the gap. The preferred form of estimation is therefore the time series analysis from 1990 to 2019 that grasp for the deficiencies and limitations of the above estimation methods. To the best of the author's knowledge, there is no study so far that has compared the relative contribution of all the foreign capital inflows in Ethiopia. This paper makes important contributions to the empirical literature on the link between FDI, remittances, foreign aid, external debt and economic growth of Ethiopia.

By exploring the effect of each of the capital flows, one would be able to determine in which way foreign capital contributes to the economic growth of Ethiopia. Understanding the type of foreign capital that contributes mostly to growth would help to channel efforts to attract such capital flows that would contribute most positively to sustainable growth in Ethiopia instead of just attracting all the foreign capital flows. The gap acknowledged by this study is that previous studies have not seized the changing aspects of capital inflows (FDI, remittances. ODA and debt)

1.3 Research Questions

- What is the effect of capital inflows on economic growth of Ethiopia?
- Is there the short run and long run relation between capital inflow and economic growth?

1.4 General Objective

The study is aiming at analyzing the impact of Capital inflows on economic growth of Ethiopia

1.5 Specific Objectives

- To examine the effect of capital inflows on economic growth of Ethiopia.
- To investigate the short run and long run impact of capital inflow on economic growth.

2.1 Theoretical Review

FDI is an investment in a business by an investor country for which the foreign investor has control over the company purchased. OECD defines "control" as owing 10 percent or more of business. FDI can be a tremendous source of external capital for a developing country, which can lead to economic development. FDI may also provide some great advantages for multinational corporations such as access to foreign markets, access to natural resources and it reduces the cost of factors production (www.oecd.org, 2018).

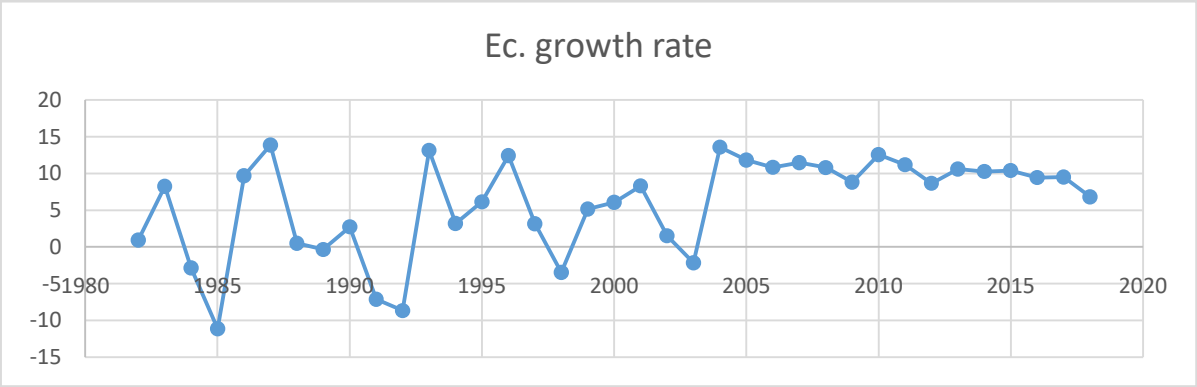
Remittances are mainly in the form sent by non-resident to their household (resident) in the home country. In other words, PR are defined as transfers of a sum of money that follow unidirectional paths from a migrant to his or her sending relations and or friends, community, and country (Majumder & Donghui, 2016). Remittances are one of the largest sources of external funding for developing countries and three times the size of ODA while supplementing the domestic incomes of millions of poor families across the world.

ODA refers to foreign aids, in other words, the flow of financial resources from the central or local government of donor countries and multilateral agencies to developing countries. ODA is intended to promote the economic development and to improve the quality of life in developing countries (www.oecd.org, 2018).

Economic Growth: economic growth is an increase in the production of products and services over a particular period. To be most precise, the measuring should take away the effects of inflation. Economic growth creates additional profit for businesses. As a result of stock prices rise that provides companies capital to speculate and hire additional employees. As additional jobs are created, incomes rise. shoppers have more cash to shop for extra product and services. Purchases drive higher economic growth. For this reason, all countries wish positive economic growth. This makes economic growth the foremost watched economic indicator. Gross domestic product is that the best ways to measure economic growth. It takes under consideration the country's entire economic output. It includes all merchandise and services that companies within the country manufacture purchasable. It does not matter whether or not they are sold domestically or overseas. GDP measures final production. It includes exports as a result of their produced within the country. Imports are subtracted from economic growth. Most countries measure economic growth every quarter. The good measuring of economic growth is real gross domestic product. It removes the results of inflation. The gross domestic product rate of growth uses real gross domestic product. the World Bank uses gross national income rather than gross domestic product to measure growth (Kemberly, 2019).

2.1.1 Over view of Ethiopian Economy

Ethiopia's location gives it strategic dominance as a jumping off point in the Horn of Africa, close to the Middle East and its markets. Bordering Eritrea, Somalia, Kenya, South Sudan, and Sudan, Ethiopia is landlocked, and has been using neighboring Djibouti's main port for the last two decades. However, with the recent peace with Eritrea, Ethiopia is set to resume accessing the Eritrean ports of Assab and Massawa for its international trade. With about 110.1 million people (WDI, 2019) estimation, Ethiopia is the second most populous nation in Africa after Nigeria, and the fastest growing economy in the region. However, it is also one of the poorest, with a per capita income of $786. Ethiopia's economy experienced strong, broad-based growth averaging 10.3% a year from 2006/07 to 2017/18, compared to a regional average of 5.4%.



Source: Own computation based on World Bank Data, 2020
Figure 2.1 Trends for Rate of Economic Growth.

2.2 Empirical Review

Narayan (2013) studied the casual relationship between foreign capital inflows and economic growth in India. Using the pair-wise Granger causality test (1969), he specifically examines causal relationship between foreign capital inflows and economic growth in India. The significant observations developed from pair-wise Granger causality test, which shows there is the long-run equilibrium relationships exist between the pairs of variables and economic growth like Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI).

Aurangzeb and Haqq, (2012) investigated the effect of foreign capital inflows on economic growth of Pakistan. The data used in this study were collected from the period of 1981 to 2010. The multiple regression analysis technique was used to identify the significance of different factors. Results indicate that the all three variables are having positive and significant relationship with economic growth (GDP). The Granger-Causality test confirms the bidirectional relationship between remittances and external debt, gross domestic product and external debt, foreign direct investment and external debt, and foreign direct investment and remittances. On the other side, the study found unidirectional relationship from gross domestic product to foreign direct investment. It is concluded that the foreign capital inflows are very important for the growth of any economy.

Obie china and Ukeje (2013) examined the impact of capital flows (foreign direct investment), exchange rate, export and trade openness on economic growth of Nigeria as well as the causal long-run relationship among the variables, using time series data from 1970 – 2010. The Johansen Co-integration test suggested the existence of at least one Co-integration vector among the variables. Using Engle-Granger 2-Step procedure, it was observed that all the variables, but the FDI are statistically significant and stimulate economic growth in the short-run dynamic equilibrium model. Exogeneity test confirmed that FDI has weak exogeneity with economic growth. In addition, the Pairwise Granger causality revealed the existence of Uni-directional causality between economic growth and FDI, and Uni-directional and bi-directional causality among some of the variables.

Olusanya (2013) takes a look at the impact of Foreign Direct Investment inflow and economic growth in a pre and post deregulated Nigerian economy, a Granger causality test was use as the estimated technique between 1970 - 2010. However, the analysis de-aggregates the economy into three period; 1970 to 1986, 1986 to 2010 and 1970 to 2010, to test the causality between foreign direct investment inflow (FDI) and economic growth (GDP). However, the result of the causality test shows that there is causality relationship in the pre-deregulation era that is (1970-1986) from economic growth (GDP) to foreign direct investment inflow (FDI) which means GDP causes FDI, but there is no causality relationship in the post-deregulation era that is (1986-2010) between economic growth (GDP) and foreign direct investment inflow (FDI) which means GDP causes FDI. However, between 1970 to 2010 it shows that is causality relationship between economic growth (GDP) and foreign direct investment inflow (FDI) that is economic growth drive foreign direct investment inflow into the country and vice versa.

Mulugeta (2014) also investigated the impact of external debt on economic growth in Ethiopia which covers the time series data for the period 1983/84 to 2012/13 by using the Johansen Maximum Likelihood approach of VAR model and he revealed that real GDP is influenced negatively by the past stock of external debt and debt servicing and, positively by the current external debt inflows. A study by Wosene (2014) indicated that the

relationship between external debt and economic growth both in the short run and long run is significant with a negative sign and the debt servicing variable has insignificant effect on economic growth.

Solomon (2016) investigated the impact of external debt on the Nigeria economy. Data was collected from the secondary source while the regression and granger causality methods of analysis were applied. The outcome of the regression analysis showed that external debt and external debt service have negative relationship with GDP. The granger causality test shows that GDP has a unidirectional causal relationship with external debt service which runs from GDP to external debt service, uni-directional causality exists between external debt and GDP which runs from external debt to GDP. It recommends that external debt should largely be for economic reasons rather than social or political reasons as this would increase the productivity of the nation.

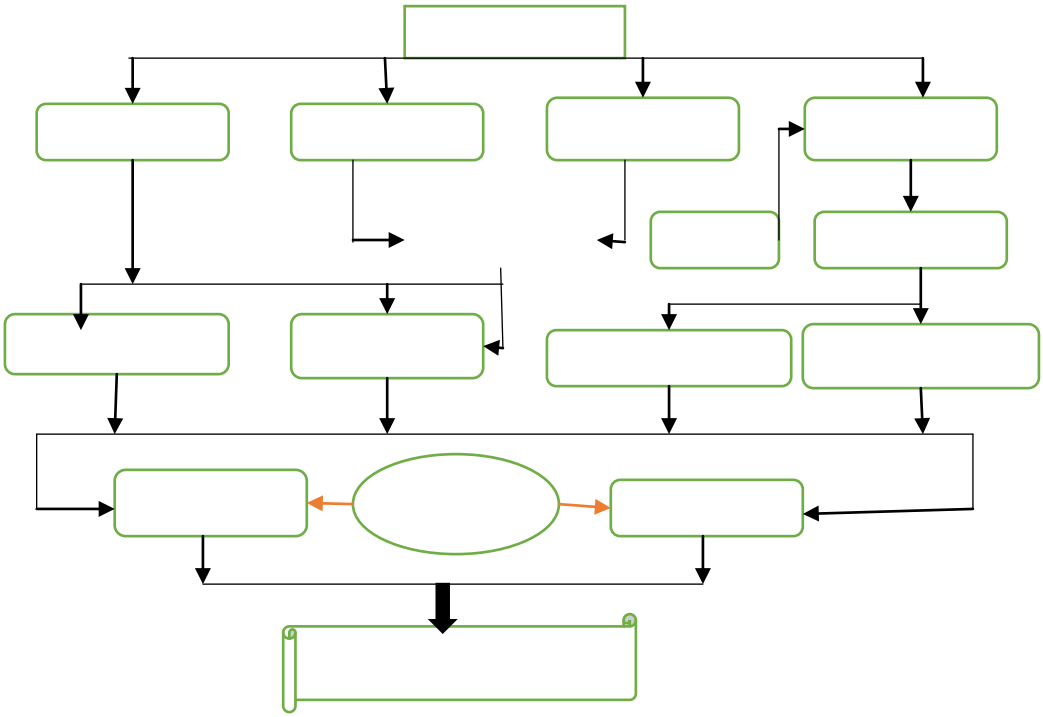
A study by Williams (2018), has examined whether the relationship between economic growth and remittances depends on the quality of democratic institutions for 109 developing countries for the period 1975-2014. The result shows that remittances have a negative effect on growth in poor quality democratic institutions but the effect turns out to be positive as the democracy improves which implies; as democracy improves, recipient families are more likely to invest in human capital or invest small business activities which in turn would increase the growth rate of the economy.

Ibrahim (2018), using a balanced panel data of five Sub-Saharan African countries from 1984 to 2014. Panel fixed effects are used to estimate the effect of remittances and institutional development on domestic investment, while controlling for the level of economic development, the estimates indicate that remittances exert a significant positive effect on domestic investment. Also, the interaction effect of remittances and institutions shows that political institution serves as a mechanism through which remittances impact domestic investment. Besides, the interaction of financial development and remittances yields a modest impact on investment. The findings indicate that the effect of remittances on investment are larger in the presence of better financial institutions.

The study of Robert *et al*. (2019), which captured the dataset consists of 57 countries for the period from 1991 to 2017. Using linear regression models, the results suggests that the remittance flows contribute the increased volatility which tends to appear negatively to sustainable economic growth only when the remittance flows represent a relatively higher share of GDP.

2.3 Conceptual framework.

According to theoretical and empirical literature, the impacts of capital inflow on economic growth has got controversial argument in receiving countries. Because of the scattered evidences, there is a need to bring the channels, through which capital inflow have an effect on the remittance receiving countries, collectively (Guha, 2013). The channels work through the macro and micro stage of the recipient economies. The impact on the macro level is dependent on whether or no longer the income is spent on domestic or foreign items as properly as if it is spent on investment or consumption. Therefore, an analysis allows for both positive and negative effects, is integral when evaluating capital inflow impact on economic growth. This find out about ambitions to seize the net impact capital inflow have on the economic growth of Ethiopia (1990-2020), conscious of the fact that there are channels working in contrary directions leading to each negative and positive consequences.



Source: Computed by Authors based on Literature reviews
Figure 2.3 conceptual framework design based on the work of Robert *et al*. (2019)
Control variables: Gross Capital Formation (GCF), Terms of Trade (OP) and Unemployment Rate (UR)

3. Methodology

In order to undertake the study, the researcher has based on secondary data collected on Ethiopian macroeconomic variables set which is being accrued from unique sources. The cause for the use of secondary data was once that it saves time and its rules out the option of accumulating unfair data from fundamental sources, it additionally provides large and higher quality databases that would be unfeasible for any individual researcher to accumulate on their own.

This study uses the endogenous growth model usually known as the "AK model" – used by Pagano (1993) and its extended form by Baillieu (2000), who introduced international capital flows to capture the relationship between foreign capital flows and economic growth. Here, the aggregate output is a linear function of the aggregate capital stock.

$$Y_t = AK_t \quad \ldots\ldots 1$$

where the above is a typical growth function,
Yt = aggregate output in time (*t*);
Kt = capital stock in time (*t*) which is a combination of both physical and human capital; and
A = Total Factor Productivity (TFP).
Certain assumptions are made: (i) the population is constant; and (ii) the economy produces a single good which can either be consumed or invested. If invested, the capital stock depreciates at the rate of δ per period, and then gross investment is given by;

$$I_t = K_{t+1} - (1-\delta)K_t \quad \ldots\ldots 2$$

However, the transmission of savings into investment requires financial intermediaries where a proportion of savings (1-ϕ) is taken as compensation for services offered. The remaining proportion of savings is equal to investment in the capital market equilibrium state in a closed economy.

$$\phi S_t = I_t \quad \ldots\ldots 3$$

The growth rate of output g from equations (1) - (3) without the time indices is given by;

$$g = A\left(\frac{I}{Y}\right) - \delta = A\phi s - \delta \quad \ldots\ldots 4$$

where *s* = gross saving rate. Equation (4) is the steady state growth rate of a closed economy.
The above framework is extended to integrate foreign capital flows that draw on the work of (Bailliu, 2000 & Aziakpono, 2013). The closed economy assumption will be relaxed here to allow for free movement of capital

into and out of the domestic economy. The above equilibrium conditions can be modified to adjust for the effects of foreign capital flows as follows;

$$\phi''(S_t + FCF_t) = I_t'' \ldots\ldots\ldots\ldots\ldots 5$$

where *FCFt* is the net foreign capital flows and **(")** represents open economy. The new steady state growth rate can be expressed as;

$$g'' = A'' \frac{I''}{Y} - \delta = A'' \phi'' \frac{S + FCF}{Y} - \delta = A'' \phi'' S'' - \delta \ldots\ldots\ldots 6$$

In the absence of any friction, the model suggests an increase in capital flows to the developing country ($FCF_t > 0$), which will help to augment domestic savings ($s'' > s$). In a situation where the foreign capital inflow is invested productively and not consumed, the level of domestic investment in the developing country will rise, which in turn will lead to an increase in economic growth (g''> g). (Omolola, 2017)

After reviewing the theoretical and empirical work, the model to examine the impact of remittances on economic growth is derived using the production function framework. Putting the production function in general form as follows:

$$Y = f(A, L, K) \ldots\ldots\ldots\ldots\ldots 7$$

Where Y is the real gross domestic product, L is the total labor force and K is the capital stock. The variable A captures the total factor productivity (TFP) effect on the growth in output not accounted for by increasing in factor inputs (L and K). According to the new (endogenous) growth theory, A is endogenously determined by economic factors and can be specified using observable factors. Lucas (1988), Barro (1990) and Adenutsi (2011) showed the effect of capital inflow on economic growth can also be formulated within the endogenous growth model setup (Abdullatif *et al.*, 2013). If capital inflow is spent on investment, endogenous growth model provides the channel through which capital could promote economic growth (Romer 1990) Therefore, based on the arguments mentioned above, TFP can be formulated simply as:

$$A = f(FCF) \ldots\ldots\ldots\ldots\ldots 8$$

In conclusion, following the above explained arguments and formally stating the equations using Cobb-Douglas production function in which output is a function of physical capital (K) and labor force (L);

$$Y = AK^{a}L^{1-a}e^{U} \ldots\ldots\ldots\ldots\ldots 9$$

Taking the natural logarithm (L) transformation of equation 9 both sides and expanding it to time dimension gives:

$$\mathrm{L}(Y_t) = \mathrm{L}(A_t) + a\,\mathrm{L}(K_t) + (1-a)\,\mathrm{L}(L_t) + U_t \ldots\ldots\ldots\ldots\ldots 10$$

Since A is total factor productivity (TFP) which is in turn determined by the available stock of Human capital (H) and foreign capital inflow income can replace factor productivity, by taking the natural logarithm of the function which can be stated as:

$$\mathrm{L}(A_t) = b_0 + b_1\,\mathrm{L}(FCF_t) \ldots\ldots\ldots\ldots\ldots 11$$

By Substituting equation (10) into equation (11);

$$\mathrm{L}(Y_t) = b_0 + b_1\,\mathrm{L}(FCF_t) + a\,\mathrm{L}(K_t) + (1-a)\,\mathrm{L}(L_t) + U_t \ldots\ldots\ldots\ldots\ldots 12$$

Replacing $\mathrm{L}(Y_t)$ by $\mathrm{L}(RGDP_t)$ and capturing the extended variables those can affect economic growth in addition to foreign capital inflow have stated as:

$$\mathrm{L}(RGDP_t) = b_0 + b_1\,\mathrm{L}(RE) + b_2\mathrm{L}(AID) + b_3\,\mathrm{L}(FDI_t) + b_4\ln(DBT_t) + b_5\,\mathrm{L}(GCF_t) + b_6\,\mathrm{L}(OP_t) + b_7\,L(UR_t) + U_t \ldots\ldots\ldots\ldots\ldots 13$$

As highlighted in the previous chapter, the literature is explicit on the way in which the different forms of capital will contribute differently to growth. Where:

$\mathrm{L}(RGDP_t)$ is natural log of Real Gross Domestic Product at a time t, is the market value of the goods and services produced by an economy over time which is measured as the percentage rate of increase in real Gross Domestic Product. Since most economists argue that economic growth can be measured as growth in real GDP.

$\mathrm{L}(RE_t)$ is natural log of remittance at a time t, is the currency that is sent back by migrants to their home, relatives or other associates in their countries of origin (Ostropolski, 2015).

$\mathrm{L}(FDI_t)$ is natural log of foreign direct investment at a time t, is viewed as how an investing country exercises de facto or de jure control of at least 10 per cent or more interest in an enterprise's voting rights (Jhingan, 2012).

$\mathrm{L}(DBT_t)$ is natural log of external debt at a time t, is the portion of a country's debt that was borrowed from foreign lenders including commercial banks, international financial institutions like IMF, WB and African Development Bank (ADB) etc. and from the government of foreign nations. These loans, including interest, must usually be paid in the currency in which the loan was made. It is expected to have a negative impact on output growth because of debt service repayment cost on loan (Amsalu, 2017).

$\mathrm{L}(AID_t)$ is a natural log of foreign aid has mixed impact on economic growth with positive effects where adequate policies are put in place and executed.

IR is inflation rate at time t, is defined as an increase in the overall price level in the country and measured in percent. It will be expected to have negative impact on the Ethiopian economic growth (NBE, 2018).

$L(OP_t)$ is natural log of terms of trade proxied by the sum of Export and Import as a ratio of gross domestic product at a time t and e_t is error terms at a time t capturing unexplained position and it follows the assumption of Least square method, iid $(0, \sigma^2)$. finally, the $b_1, \ldots b_7$ are coefficients of the respective variables.

The ARDL approach requires three steps. the primary step is to visualize the existence of long run relationship among the variables of interest that's determined by F- test. The second step requires the estimation of long run relationship and to determine their values, thereafter the short run elasticity of the variables with error correction representation of the ARDL model. The purpose of applying the error correction method of the ARDL model is to determine the speed of adjustment to the equilibrium. Meaning that the ECM estimates the speed at which our dependent variable returns to the equilibrium given the change in the independent variable. The ARDL bounds test modeling involves estimating the following unrestricted error correction model (UECM) using LS method. The ARDL model shown as;

$$\Delta y_t = \beta_0 + \sum_{i=0}^{p} \delta_{1i}\Delta y_{t-1} + \sum_{i=0}^{q} \delta_{2i}\Delta x_{t-1} + \varphi_1 y_{t-1} + \varphi_2 x_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 14$$

Where, δ_i are ARDL short run coefficients

φ_1 and φ_2 are ARDL long run coefficient

μ_t is disturbance (white noise) term

$$\begin{aligned}\Delta LRGDP_t = \beta_o &+ \sum_{i=1}^{p} \delta_{1i}\Delta LRGDP_{t-1} + \sum_{i=0}^{q} \delta_{2i}\Delta LRE_{t-i} + \sum_{i=0}^{q} \delta_{3i}\Delta LAID_{t-i} + \sum_{i=0}^{q} \delta_{4i}\Delta LFDI_{t-i} \\ &+ \sum_{i=0}^{q} \delta_{5i}\Delta LDBT_{t-i} + \sum_{i=0}^{q} \delta_{6i}\Delta LGCF_{t-i} + \sum_{i=0}^{q} \delta_{7i}\Delta LOP_{t-i} + \sum_{i=0}^{q} \delta_{8i}\Delta LUR_{t-i} + \varphi_1 \Delta LRGDP_{t-1} \\ &+ \varphi_2 \Delta LRE_{t-1} + \varphi_3 \Delta LAID_{t-1} + \varphi_4 \Delta LFDI_{t-1} + \varphi_5 \Delta LDBT_{t-1} + \varphi_6 \Delta LGCF_{t-1} \\ &+ \varphi_7 \Delta LOP_{t-1} + \varphi_8 \Delta LUR_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 15\end{aligned}$$

Note that: *L* represents Natural Logarithms, Δ is first difference of the vectors, *t* is time period; $\boldsymbol{\delta_{1i}}$ to $\boldsymbol{\delta_{8i}}$ represent ARDL short run coefficients; $\boldsymbol{\varphi_1}$ to $\boldsymbol{\varphi_8}$ represent ARDL long run coefficients and $\boldsymbol{\mu}$ represents error terms which refers to residual error term which is assumed to be white noise having mean zero and variance co-variance of σ^2. In order to test the presence of long run relationship between the underlying variables, the above equations are estimated using Least Square method. To test the significance of lagged levels of the variables in this study, the appropriate test statistics is the familiar F or Wald test under the generalized Dickey-Fuller types of regressions in an unrestricted error correction regression.

Hypothesis for long run relationships; H_o: No level relationship.

This study is not however using the critical values developed by Pesaran, because it is based on large sample size observation (500 and above). This study rather used the critical values developed by Narayan (2005) which is based on small sample size between 30 and 80 observations.

Determination of optimal lag structure is crucial in ARDL model, because it helps us to address the issue of over parameterizations and to save the degree of freedom (Taban, 2010). In this study, an AIC is used to determine the maximum lag order of the ARDL model because of its advantage for small sample size as it is the case in this study.

3.1 Long Run Model presentation

The long run estimation is once tasted after ARDL model, for the result of the F-statistics and t-Statistics passes above the upper bound critical value, it realizes the existence of long run relationship and then the long run model will be estimated by OLS. For further realization of the long run existence, one should estimate the long run model by Least Square method and check for the stationarity of its residual weather it is stationary at level, to confirm it again the residual must be stationary at level.

$$\begin{aligned}LRGDP_t = \beta_0 &+ \varphi_{11} LRGDP_{t-1} + \varphi_{21} LRE_{t-i} + \varphi_{31} LAID_{t-i} + \varphi_{41} LFDI_{t-1} + \varphi_{51} LDBT_{t-1} + \varphi_{61} LGCF_{t-1} \\ &+ \varphi_{71} LOP_{t-1} + \varphi_{81} LUR_{t-1} \\ &+ \mu_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 16\end{aligned}$$

3.2 Short Run Model presentation

Then after, the short run dynamics of the model by estimating the Error Correction Dynamics associated with the long run estimates; This model is:

$$\begin{aligned}\Delta LRGDP_t = \beta_o &+ \sum_{i=1}^{p} \delta_{1i}\Delta LRGDP_{t-1} + \sum_{i=0}^{q} \delta_{2i}\Delta LRE_{t-i} + \sum_{i=0}^{q} \delta_{3i}\Delta AID_{t-i} + \sum_{i=0}^{q} \delta_{4i}\Delta LFDI_{t-i} + \sum_{i=0}^{q} \delta_{5i}\Delta LDBT_{t-i} \\ &+ \sum_{i=0}^{q} \delta_{6i}\Delta LGCF_{t-i} + \sum_{i=0}^{q} \delta_{7i}\Delta LOP_{t-i} + \sum_{i=0}^{q} \delta_{8i}\Delta LUR_{t-i} + \theta ECT_{t-1} \\ &+ \mu_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 17\end{aligned}$$

Where: ECT_{t-1} represent the error correction term that will be obtained from ARDL long run dynamics of the model and it is expected to have negative sign showing the eliminating speed of the model. In other words, it is the speed of adjustment to restore equilibrium in the dynamics model (how quickly the variables converge to equilibrium aftershocks).

4. Result and Discussion

4.1 Econometric Analysis

This section is starting with the distribution of variables instrumented for study, descriptive statistics and go through the inferential statistic in order to conclude good result (**see Appendix 1**).

JarqueBera: is the test statistic measures of difference of the skewness and kurtosis of the series with those from the normal distribution. Then the probability that a JarqueBera statistic exceeds (in absolute value) the observed value under the null-hypothesis – a small probability (<5%) value leads to the rejection of the null hypothesis of a normal distribution. H_o: For the JarqueBera, the distribution is normal for p-value > 5%. Based on the summary statistics the probability value of Aid & TO and Ur are greater than 5%, then the null hypothesis of normal distribution is accepted and for the RGDP, REM, FDI, GCF, DBT and IR the probability value is less than 5%, thus the null hypothesis of normal distribution is rejected which needs to transform to its logged form.

4.2.2 The Correlation Matrix

These results seem to confirm the economic theory according to which all these factors influence output. The estimation of the model in **(see appendix 2)** allows us to conduct a further analysis of this phenomenon.

4.2.3 Results for Unit Root Tests

As it is discussed in chapter three of this paper, it is a vital and important to test the nature of stationarity of the variables before running the model which used to determine the existence of long run relationship among the variables. Doing so avoids the possibility of running a spurious regression, which makes the result to be unreliable and inconsistent. The ADF and PP test results of the variables used in the study is presented in the following table.

Table 4.1 Results of Augmented Dickey Fuller and Philips-Perron Test of I (0).

Var.	**ADF testing statistics at level, I(0)**			**PP testing statistics at level, I(0)**		
	Intercept	Int. & trend	None	Intercept	Int. & trend	None
LRGDP	-1.4720	-2.1872	-0.0412	-1.7993	-2.2420	-0.0416
LFDI	-4.1797***	-3.5896**	2.3199**	-4.1618***	-3.7154**	2.3559**
LDBT	-0.5053	-0.8426	0.7248	-0.5053	-1.0814	0.6600
LRE	-2.2271	-3.8171**	-1.7567*	-2.2640	-1.9446	-2.4974**
LGCF	-0.1477	-3.0141	0.6568	-0.1477	-3.1198	0.6568
LOP	-2.8718*	-0.5087	0.3939	-2.1410	1.7004	0.5927
LAID	-1.9059	-1.9372	-1.3262	-1.9312	-1.9285	-2.4419
LUR	-2.9181*	-10.572***	-0.1732	-1.9679	-1.6416	0.2511

Source: E-views 10 output, 2020

If the ADF and PP test statistics is less than the critical value, the decision rule is failed to reject the null hypothesis of unit root or non-stationarity. In this case the time series variables are non-stationary or has unit

root. Conversely, in case where the ADF and PP test statistics is greater than the critical value indicates rejection of the null hypothesis implying the stationarity of the time series variable. As table 4.3 above indicates, the null hypothesis of no stationarity (unit root) cannot be rejected for all variables in level except for IR which is stationary at 1%, 5% and 10% level of significances.

Table 4.2 Results of Augmented Dickey Fuller and Philips-Perron Test of I (1).

Var.	**ADF testing at 1st difference, I (1)**			**PP testing at 1st difference, I (1)**		
	Intercept	Int. & trend	None	Intercept	Int. & trend	None
LRGDP	-3.5509**	-4.3590***	-3.6214***	-3.5525**	-4.3468***	-3.6228***
LFDI	-6.0552***	-5.8931***	-6.0064***	-8.1276***	-7.1815***	-6.1588***
LDBT	-4.1367***	-4.3410**	-4.1547***	-4.1855***	-4.3332**	-4.2020***
LRE	-5.4099***	-5.4988***	-5.3718***	-5.4129***	-5.5182***	-5.3718***
LGCF	-4.3348***	-4.8054***	-4.3024***	-4.2911***	-4.7609***	-4.3024***
LOP	-3.6143**	-5.5379***	-3.5943***	-3.6143**	-5.8164***	-3.5979***
LAID	-7.4337***	-7.2920***	-7.6058***	-12.445***	-12.894***	-12.910***
LUR	-5.2593***	-4.3096**	-5.6650***	-2.1417	-2.2954	-2.1235**

Source: E-views 10 output, 2020

Mackinnon (1996) Critical Values

Mackinnon Critical Values	Level	Intercept	Intercept and trend	None	Significance
	1%	-3.626784	-4.226815	-2.628961	***
	5%	-2.945842	-3.536601	-1.950117	**
	10%	-2.611531	-3.200320	-1.611339	*

Source: Mackinnon (1996) Critical Values for unit root tests.

Every variable become stationary once they are first differenced. This indicates that none of the above variables are integrated of order two (I (2)), which is a pre-condition to use ARDL model. as a result, Auto-regressive Distributed Lag model is the right technique to apply in this scenario.

Lag Selection Criteria

The easiest way out of this quagmire, is to decide using a criterion like Akaike, Schwarz and Hannan, but choosing the model that gives the lowest values of these criteria (rule-of-thumb), economists use Akaike Information Criteria most often for its lower value, so econometric packages can easily compute these optimal lag lengths (Gujarati, 2004; Asteriou, 2007)

Table 4.3 Selection-order criteria by Akaike Information Criterion

Matrix list e(lags), actual lag presentation

e(lags) [1,8]

Variables	Lrgdp	Lre	Laid	Lfdi	Ldbt	Lgcf	Lop	Lur
Lags	2	2	2	0	2	1	1	2

Source: Computation from Stata 13, 2020

4.2.6 Bound Tests for Long Run Relationships

In the ARDL approach to Co-integration, the first step is to test the presence of co-integration or long run relationship among the variables. This test for the long run relationship is done using the F-statistic. Given the annual nature of the data; it is recommended that the optimal lag length for the ARDL model is maximum two lags. Moreover, AIC is used to determine the optimal lag because of small sample size at hand.

The test procedure starts with estimating an OLS regression for the first difference part of equation (equation 16) and then test for the joint significance the parameters of the lagged level variables when added to the first difference regression. Pesaran (2001) explained that this OLS regression in first difference is of no direct interest to the bounds cointegration test, it is rather used to simply look at the joint significance of the variables. The F-test statistics, which is derived from this regression output, tests the joint null hypothesis that the coefficients of lagged level variables are zero meaning; there is no long run relationship. See Bound test for Co-integration below

Table 4.4 Critical values for upper and lower bound

Critical values		**F = 8.80**		**Narayan (2005), k=7, n=28**		
(0.1 – 0.01)		LB I (0)	UB I (1)	UB I (1)	LB I (0)	UB I (1)
Case 5						
0.010	1%	3.31	4.63	-5.19	4.104	6.151
0.050	5%	2.69	3.83	-4.57	2.875	4.445
0.100	10%	2.38	3.45	-4.23	2.384	3.728

Source: Critical values from Pesaran/Shin/Smith (2001) & Narayan (2005)
Where, k: number of non-deterministic regressors in long-run relationship
H_0: no levels relationship
Accept if F < critical value for I (0) regressors; reject if F > critical value for I (1) regressors.

Based on the ARDL bound tests result, by including the constant (case III), the calculated F statistics (8.80) is higher than the Pesaran/Shin/Smith (2001) upper bound critical value at 1% through 10% level of significance which means, 6.1, 4.4 and 3.5 respectively. As a result, it is possible to reject the null hypothesis of no co-integration. In other words, the result implies that the variables are co-integrated in the long run.

4.2.7 Post Estimation Diagnostic Test

Table 4.5 Diagnostic tests

Test statistics	F version	Analysis
Heteroskedasticity	F (19, 7) = .8042[0.67] **	There is no heteroscedasticity problem due to 0.67 > 0.05

Functional Form	F (1, 18) = .5535[0.46] **	The model is correctly specified because 0.46 > 0.05.
Normality	Not applicable	The residuals are normally distributed because 0.97 > 0.05
Serial Correlation	F (2, 17) = 0.9881 [0.39] **	There no serial correlation because 0.39 > 0.05.

Source: Author's Computation from EViews 10, 2020

The results of *F*-statistic indicate that there is no serial correlation problem; the model is correctly specified; the errors are normally distributed and there is no heteroskedasticity problem in the model.

Pesaran and Shin (1997) further suggested that structural stability or presence of structural break of the long run and short run relationships for the sample period can be better examined by cumulative sum (CUMSUM) and the cumulative sum of squares (CUMSUMSQ) of the recursive residual test. The test is based on the first set of n observations and is updated recursively which will then be plotted against the break points to assess the given parameter consistency. For the stability test the graph plots both the cumulative sum and the 5% critical lines. And, if the cumulative sum remains inside between the two critical lines or bounds back after it is out of the boundary lines, the null hypothesis of correct specification of the model cannot be rejected.

4.2.8 Long Run ARDL Result

Based on the confirmation obtained from the unit root test about the absence of a variable which is integrated of order two and given the F statistic result which indicated the existence of long run co-integration among the variables, it is now possible to proceed to the estimation of the long run coefficients of the model. The following table presents the results found after running the appropriate ARDL model to find out the long run coefficients. The figures in bracket are number of lags chosen by the model for each variable.

Table 4.6 Estimated Long Run Coefficients using the ARDL Approach

Levels Equation, Dependent variable LRGDP, ARDL (2, 2, 2, 0, 2, 1, 1, 2) AIC

Case V: Unrestricted Constant and Trend Obs.=28 Dated: 1990-2019

Variable	Coefficient	Std. Error	t-Statistic
LRE	-0.086586***	0.020223	-4.281560
LAID	0.583965**	0.246376	2.370219
LFDI	0.047348***	0.014364	3.291713
LDBT	-0.216204**	0.074253	-2.911733
LGCF	1.679234***	0.387967	4.328289
LOP	-0.403761**	0.135612	-2.977325
LUR	-1.075669**	0.442763	-2.429448

EC = LRGDP - (0.0865*LRE + 0.5840*LAID + 0.0473*LFDI -0.2162*LDBT +1.6792*LGCF - 0.4038*LOP - 1.0757*LUR)

Source: EViews 10, Own Computation, 2020.
Notes: ***, ** & * represent the probability value and significance at 1%, 5% and 10% respectively.

LRE (remittance): The estimated long run coefficient for remittance shows negative and significant impact on the real GDP during the study period. That is, holding other things constant, a ten percent increase in remittance inflow leads to a 0.86 percent decrease in real GDP. This may be due to the fact that remittances directly used for smoothening household consumption and ease leisure constraint (Qayyum et al., 2008). The significant portion of remittance inflows is not directed to productive investments in the long run, and but the short run effect has a multiplier effect.

LAID (Foreign aid): The estimated long run coefficient for remittance shows positive and significant impact on the real GDP during the study period. That is, holding other things constant, a one percent increase in foreign aid leads to a 0.58 percent increase in real GDP. This implies aid is effective in promoting economic growth in the long run only for the purpose of investment rather than personal use and it may be used in other activities which are necessarily beneficial for the recipient countries' economic growth by increasing income level or perhaps the higher income countries themselves start to realize slower growing rate due to diminishing marginal product of production factors (Ali, 2014).

Foreign Direct Investment (lnFDI): The estimated long run coefficient for foreign direct investment is significant at 1%, positive and confirming a 10 percent increase in FDI will impact positively the output level by 0.47 percent taking other things unchanged. This result can be explained by the fact that FDI inflows is seen as an important source of savings and capital accumulation for Ethiopia, creating positive spillovers, improving human capital, providing access to advanced technologies and thus lead more economic growth (Malikane & Chitambara, 2017).

External Debt (LDBT): The estimated long run coefficient for debt is significant at 5%, negative and robust result revealing a 5% increase in external debt will impact the output level by 0.21 percent taking other things constant. The finding indicated that external debt burden had an adverse effect on the national income and per capital income of the nation. Large portion of external debt directed to depreciation of the country exchange, rise in retrenchment of workers, continuous business assault and lessen educational system.

Gross Capital Formation (LGCF): The domestic investment measured by gross capital formation is positive and strongly significant at 1% level in the long run. In fact, holding others' constant a 1% variation of physical capital leads to an increase of economic growth by 1.67%. The decomposition of this capital shows a domination of fixed and movable assets. This physical capital spur production via reduction in unexploited time and permitting standard goods and service availability. There are ongoing efforts in Ethiopia to provide a favorable framework or climate for private investments.

Terms of Trade (LOP): The long run estimation result for the terms of trade is significant at 5% and indicating negative effect on economic growth by 0.40 percent for its variation by 5%. This shows that one of the mechanisms through which trade contributes to growth is through the terms of trade effects on the domestic economy. The general belief is that trade openness to international trade is beneficial to economic development, especially for developing countries**.**

Unemployment Rate (LUR): The result indicates that both unemployment and real GDP are statistically significant negatively at 5% level; taking others constant an increase in real GDP by 1% leads to decrease the unemployment rate by 1.07%. This could be attributed to the fact that the longer the period people become unemployed, the more they become fade up of waiting for employers to get a job and engage in other alternatives of income generation mechanisms like going to other countries outside, or engaging themselves in other sources such as the informal sectors.

Long run model: the parenthesis represents t-statistics and * significance

LRGDP = - 12.7 - 0.06Tr - 0.0865LRE + 0.5839LAID + 0.0473LFDI - 0.2162LDBT +

(-10.03) * (-9.95)* (-4.28)* (2.37)* (3.29)* (-2.91)*

1.6792LGCF - 0.4037LOP - 0.2803*LUR

(4.32) * (-2.97) (-2.42)*

4.2.9 Error Correction Model

The next step that follows from the estimation of the long run coefficients is the estimation of error correction model which is the error correction representation of the long run model. This representation shows the short run dynamics of the model along with the equilibrium of the model. Theoretically, the ECM term indicates the speed of adjustment to restore equilibrium in the dynamic model and the coefficient of the ECM which should be both negative and statistically significant, shows how quickly the dependent variable converge to equilibrium without losing its long run information (Shrestha & Chowdhury, 2005).

Table 4.7 Error Correction Representation for the Selected ARDL Model

ARDL Error Correction Regression		**Time Span 1990-2019**	
Dependent Variable: ΔLRGDP			
Selected Model: ARDL (2, 2, 2, 0, 2, 1, 1, 2), AIC		**Obs. = 28**	
ECM Regression			
Case v: Unrestricted Constant and Trend			
Variable	Coefficient	Std. Error	t-Statistic
C	-12.70938***	1.266954	-10.03144
@Trend	-0.066234***	0.006653	9.955285
ΔLRE	0.040352**	0.015576	2.590618
ΔLAID	0.029533**	0.010950	2.697077
ΔLFDI	0.077147***	0.007816	9.870910
ΔLDBT	-0.047631**	0.020393	-2.335654
ΔLGCF	1.171149***	0.058478	20.02729
ΔLOP	-0.218551**	0.086658	-2.522005
ΔLUR	-0.729354***	0.140749	-5.181943
ECM (-1)	-0.906688***	0.120333	-7.534824
R-squared	0.973158	Mean dependent var	0.000161
Adjusted R-squared	0.956315	S.D. dependent var	0.080966
S.E. of regression	0.014860	Akaike info criterion	-5.274125
Prob(F-statistic)	0.000000	Durbin-Watson	3.072632

Source: own computation by EViews 10

Notes: *, ** & *** indicates that the series are significant at 10, 5 and 1 percent, respectively.

The coefficient of the lagged error-correction term is significant at 1% significant level with the expected sign (i.e., Negative), which confirms the result of the bounds test for co-integration. Its value is found -0.90 which implies that the speed of adjustment to equilibrium after a shock is high. Approximately 90 % of disequilibria of the previous year shock converge back to the long-run equilibrium in the current year. Such highly significant Error correction term is another proof for the existence of a stable, long-run relationship among the variables (Banerjee *et al.*, 1993). Most of the results are similar in both long-run and short-run.

ΔLRE (remittance): Similarly, the result for short run for ΔLRE is positive which is statistically significant at 5% level. The estimated coefficient shows that an increase by 10% in LRE resulted economic growth to increase by 0.4%, treating others constant and it may imply the smoothing consumption and consumption multiplier of economic growth (Feyisa, 2011).

ΔLAID (foreign aid): Again, the estimated coefficient of foreign aid reveals positive and statistically significant at 5% level. Like in the long run considering other variables constant, an increase in ΔLAID by 10% leads to increase economic growth by 0.2%.

ΔLFDI (Foreign Direct Investment): The estimated coefficient of foreign direct investment is positive and significant at 1%, and the coefficient of 0.77 means letting other things unchanged a 10% increase in Foreign Direct Investment impacted economic growth positively by 0.77 % which Show that FDI is mainly market-seeking, which requires growing GDP, political stability, good infrastructure, market size as well as reduction in corruption levels.

ΔLDBT (external debts): The short run estimated coefficient of External debt is statistically significant at 5% level and has negative effect on economic growth like in the long run robust result, a 10% increase in external debt result a 0.4% decrease in economic growth citrus paribus. Debt remains negative in the time-varying analysis.

Gross capital formation (ΔLGCF): has a significant impact on economic growth with positive sign in the short run at one percent significance level. This shows that, holding other things remain constant 1% increase in domestic investment has 1.17% increase in economic growth.

Terms of Trade (ΔLOP): The short run coefficient of terms of trade is negative and significant. The coefficient of 0.21 shows that the change in terms of trade by 5% will damage the output by 0.21%. In case of Ethiopia, the imports are relatively larger than exports due to which the terms of trade have worsened over time. The main exports of the country include agriculture products, for which the demand and prices are relatively low in international market. The main imports of the country include heavy machinery, for which the price has increased over time. So, in these conditions any fluctuation in international market will affect the economy (Nzotta et al., 2013; Chinedua, 2015).

ΔLUR (unemployment rate): the estimated result of unemployment rate is significant and negative, a decrease in unemployment rate by 1% leads to increase the economies by 0.72%. the impact is similar to long run effect which affect the economic growth with high magnitude if it is not reduced by spreading investment sector.

Regarding the short run model's goodness of fit, as the table 4.9 shows, the regression result imply that real gross domestic product is good enough explained by the explanatory variables incorporated in the model. The adjusted R-squared reveals that 95% of the short-run variation in real gross domestic product is explained by the explanatory variable. The adequacy of the model is also indicated by the F-statistic, which is significant at 1% level of significance. Therefore, it can be concluded that in the long run, LRE, LAID, LFDI, LDBT, LGCF, LOP and LUR Jointly granger cause LRGDP. This further confirms causality run interactively through ECM from the explanatory variables to LRGDP.

Short run model rewrite: the parenthesis represents t-statistics and * significant

$$\Delta LRGDP = -12.70 - \underline{0.06T_t} + 0.04\Delta LRE + 0.02\Delta LAID + 0.07\Delta LFDI - 0.04\Delta LDBT +$$

$$(-10.0)^* \quad (-9.9)^* \qquad (-2.59)^* \quad (2.69)^* \qquad (-9.8) \qquad ^* \qquad (-2.3)^*$$

$$1.17\Delta LGCF - 0.21\Delta LOP - 0.72\Delta LUR - 0.90ECM(-1)$$

$$(20.0)^* \qquad (-2.52)^* \quad (-5.1)^* \qquad (-7.5)^*$$

5. Conclusion and Policy Implication

5.1 Conclusion

From the result of bound testing, the long run co-integration between dependent and independent variables confirms that; The long-run coefficient of aid and remittance have positive and significant effect on the growth of Ethiopia's economy. This is mainly because the funds are mostly connected to the productive sectors bearing investment. However, poor institutional policy arrangement and elite group corruption explain the indirect problem why the magnitude of impact is small. The short-run result is consistent with the result in the long-run analysis. The massive transfers of foreign aid are so susceptible to theft and promote continued dependency.
Foreign direct investment has long run effect positively on economic growth which is related to accumulating capital, creating positive spill over and providing advanced technologies. As well the short run effect of FDI also show the same result. While the external debt has negative long run and short run effect on economic growth revealing that a significant portion of external debt proceeds to repay other debts rather than to boost capital investment in the country and higher tax burden on capital is required to service this stock of external

debt, leading to a lower rate of return on capital, and hence lower investment and economic growth. Generally, this means the conventional view of external debt holds true and any increase in stock of external debt would worsen economic growth in Ethiopia.

5.1 Policy Implication

The foreign capital may be helpful in boosting economic growth only under the presence of appropriate monetary, fiscal and the trade policies. And much focus of the policies should be on the inflow of FDI and other form of foreign private capital, while the inflow official aid, loans, grants and debts should be minimized.

The findings of this study pose significant policy directions. Firstly, the study emphasizes the need for government and policy-makers to attract more inflow of foreign capital into the country but taking into consideration the detrimental effect of huge capital inflow into the economy. Secondly, the government should determine the optimal capital inflows that would propel investment and growth in the country. Thirdly, the government should strengthen the macroeconomic fundamentals by deepening structural reforms so as to ensure sustainable capital inflows into the country. Fourthly, the government should create an enabling environment by providing needed infrastructural facilities in a bid to attract foreign investors and encouraging domestic investment in the country.

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APPENDICIES

APPENDIX 1: DISCRIPTIVE STATISTICS SUMMARY

	LRGDP	LRE	LAID	LFDI	LDBT	LGCF	LOP	LUR
Mean	10.50977	-1.245758	8.246690	9.933363	9.952193	1.525925	10.57020	0.712539
Median	10.46379	-1.135417	8.423429	9.960642	9.931668	1.560079	7.504031	0.718668
Maximum	10.82507	-0.299965	9.614598	10.42426	10.44159	1.708307	55.24131	0.940018
Minimum	10.35173	-2.286545	5.230449	9.346547	9.730651	1.071511	-10.77339	0.485343
Std. Dev.	0.155312	0.498508	1.011475	0.269330	0.200325	0.166099	14.43107	0.126561
Skewness	1.076235	-0.122311	-1.011070	-0.131373	1.102628	-1.374317	1.540156	-0.397575

Kurtosis	2.828416	2.258219	4.061961	3.069490	3.503168	4.134648	5.467357	2.719012
Jarque-Bera	5.633937	0.737180	6.303647	0.089253	6.182233	10.68458	18.82122	0.859388
Probability	0.059787	0.691709	0.042774	0.956355	0.045451	0.004785	0.000082	0.650708
Sum	304.7834	-36.12698	239.1540	288.0675	288.6136	44.25182	306.5358	20.66364
Sum Sq. Dev.	0.675415	6.958275	28.64629	2.031082	1.123645	0.772491	5831.161	0.448495
Observations	30	30	30	30	30	30	30	30

APPENDIX 2: CORRELATION MATTRIX

Covariance Analysis: Ordinary
Date: 05/18/20 Time: 10:25
Sample: 1990 2019
Included observations: 30

Correlation Probability	LRGDP	LRE	LAID	LFDI	LDBT	LGCF	LOP	LUR
LRGDP	1.000000 -----							
LRE	-0.003876 0.9841	1.000000 -----						
LAID	0.254405 0.1829	0.660589 0.0001	1.000000 -----					
LFDI	0.426128 0.0212	0.158701 0.4109	0.238730 0.2123	1.000000 -----				
LDBT	0.784716 0.0000	0.518748 0.0039	0.669833 0.0001	0.563842 0.0014	1.000000 -----			
LGCF	-0.451615 0.0139	0.718074 0.0000	0.582533 0.0009	-0.272043 0.1534	0.106316 0.5831	1.000000 -----		
LOP	0.289481 0.1277	0.222293 0.2465	0.047035 0.8086	-0.159766 0.4078	0.228281 0.2336	0.036536 0.8508	1.000000 -----	
LUR	-0.502800 0.0054	0.304936 0.1077	0.500803 0.0057	-0.210955 0.2720	-0.137975 0.4754	0.670038 0.0001	-0.238417 0.2129	1.000000 -----

APPENDIX 3: OLS ESTIMATION

Dependent Variable: LRGDP
Method: Least Squares
Date: 06/11/20 Time: 16:53
Sample: 1990 2019
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRE	-0.121095	0.031879	-3.798608	0.0010
LAID	0.330821	0.098628	3.354225	0.0029
LFDI	-0.060256	0.018591	-3.241100	0.0038
LDBT	-0.130339	0.052396	-2.487563	0.0209
LGCF	1.057517	0.107056	9.878206	0.0000
LOP	-0.370954	0.145195	-2.554867	0.0181
LUR	0.330640	0.159025	2.079163	0.0495

R-squared	0.902577	Mean dependent var	10.50977
Adjusted R-squared	0.876007	S.D. dependent var	0.155312
S.E. of regression	0.054690	Akaike info criterion	-2.767779
Sum squared resid	0.065801	Schwarz criterion	-2.437742
Log likelihood	47.13279	Hannan-Quinn criter.	-2.664415
Durbin-Watson stat	2.505756		

APPENDIX 4: ARDL ESTIMATION

Dependent Variable: LRGDP
Method: ARDL
Date: 06/11/20 Time: 16:56
Sample (adjusted): 1992 2019
Included observations: 28 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LRE LAID LFDI LDBT LGCF LOP
LUR
Fixed regressors: C @TREND
Number of models evalulated: 4374
Selected Model: ARDL(2, 2, 2, 0, 2, 1, 1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LRGDP(-1)	-0.547098	0.336955	-1.623652	0.1556
LRGDP(-2)	0.340410	0.169889	2.003723	0.0920
LRE	0.040352	0.040977	0.984725	0.3628
LRE(-1)	0.106723	0.044063	2.422047	0.0517
LRE(-2)	0.078076	0.054407	1.435041	0.2013
LAID	0.029533	0.205566	0.143667	0.8905
LAID(-1)	0.225615	0.158332	1.424951	0.2040
LAID(-2)	0.449515	0.206982	2.171761	0.0729
LFDI	0.033000	0.027459	1.201798	0.2747
LDBT	-0.047631	0.089636	-0.531381	0.6142
LDBT(-1)	-0.124379	0.098105	-1.267817	0.2518

LDBT(-2)	-0.088881	0.076456	-1.162514	0.2892
LGCF	1.171149	0.145466	8.051039	0.0002
LGCF(-1)	0.855162	0.351726	2.431330	0.0511
LOP	-0.218551	0.170347	-1.282973	0.2468
LOP(-1)	-0.268662	0.366602	-0.732845	0.4913
LUR	0.729354	0.449083	1.624095	0.1555
LUR(-1)	0.225889	0.375129	0.602165	0.5691
LUR(-2)	0.342753	0.345077	0.993267	0.3589
C	-12.70938	6.110427	-2.079949	0.0827
@TREND	-0.066234	0.020584	-3.217712	0.0182

R-squared	0.974207	Mean dependent var	10.48834
Adjusted R-squared	0.954897	S.D. dependent var	0.138057
S.E. of regression	0.021873	Akaike info criterion	-4.755606
Sum squared resid	0.002871	Schwarz criterion	-3.747733
Log likelihood	85.20068	Hannan-Quinn criter.	-4.455913
F-statistic	51.48712	Durbin-Watson stat	3.072632
Prob(F-statistic)	0.000041		

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX 5: LONG RUN BOUND RESULT

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LRGDP)
Selected Model: ARDL(2, 2, 2, 0, 2, 1, 1, 2)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 06/11/20 Time: 16:59
Sample: 1990 2019
Included observations: 28

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.70938	6.110427	-2.079949	0.0827
@TREND	-0.066234	0.020584	-3.217712	0.0182
LRGDP(-1)*	-1.206688	0.390393	-3.090960	0.0214
LRE(-1)	0.225151	0.103380	2.177891	0.0723
LAID(-1)	0.704664	0.313550	2.247370	0.0657
LFDI	0.033000	0.027459	1.201798	0.2747
LDBT(-1)	-0.260891	0.136810	-1.906960	0.1052
LGCF(-1)	2.026312	0.411756	4.921145	0.0027
LOP(-1)	-0.487213	0.406329	-1.199061	0.2757
LUR(-1)	1.297996	0.505881	2.565813	0.0426
D(LRGDP(-1))	-0.340410	0.169889	-2.003723	0.0920
D(LRE)	0.040352	0.040977	0.984725	0.3628
D(LRE(-1))	-0.078076	0.054407	-1.435041	0.2013
D(LAID)	0.029533	0.205566	0.143667	0.8905
D(LAID(-1))	-0.449515	0.206982	-2.171761	0.0729
D(LDBT)	-0.047631	0.089636	-0.531381	0.6142
D(LDBT(-1))	0.088881	0.076456	1.162514	0.2892
D(LGCF)	1.171149	0.145466	8.051039	0.0002
D(LOP)	-0.218551	0.170347	-1.282973	0.2468

D(LUR)	0.729354	0.449083	1.624095	0.1555
D(LUR(-1))	-0.342753	0.345077	-0.993267	0.3589

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRE	-0.086586	0.020223	-4.281560	0.0078
LAID	0.583965	0.246376	2.370219	0.0555
LFDI	0.047348	0.014364	3.291713	0.0046
LDBT	-0.216204	0.074253	-2.911733	0.0269
LGCF	1.679234	0.387967	4.328289	0.0049
LOP	-0.403761	0.135612	-2.977325	0.0237
LUR	-1.075669	0.442763	-2.429448	0.0512

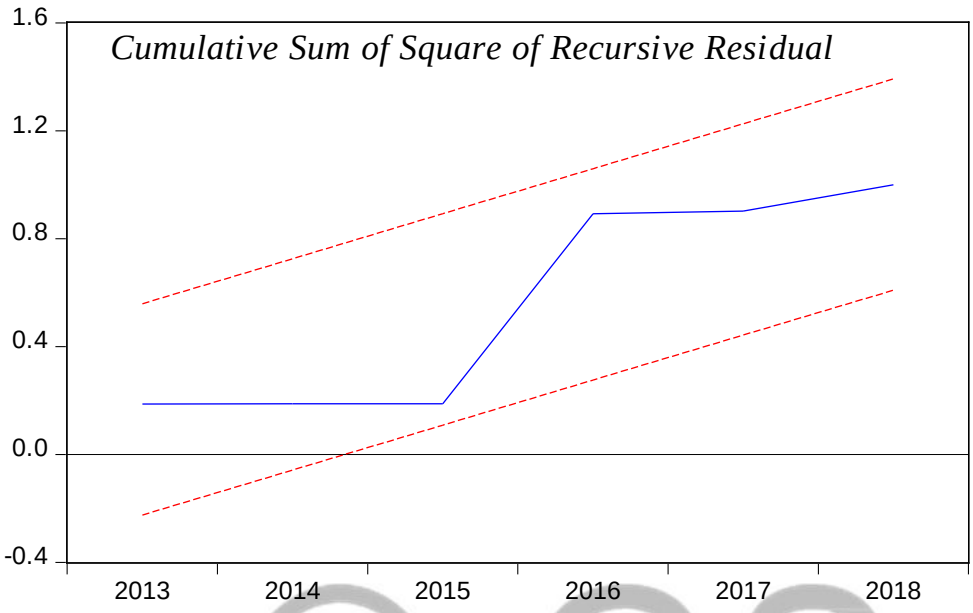
EC = LRGDP - (-0.0865*LRE + 0.5840*LAID + 0.0473*LFDI -0.2162*LDBT +1.6792*LGCF -0.4038*LOP - 1.0757*LUR)

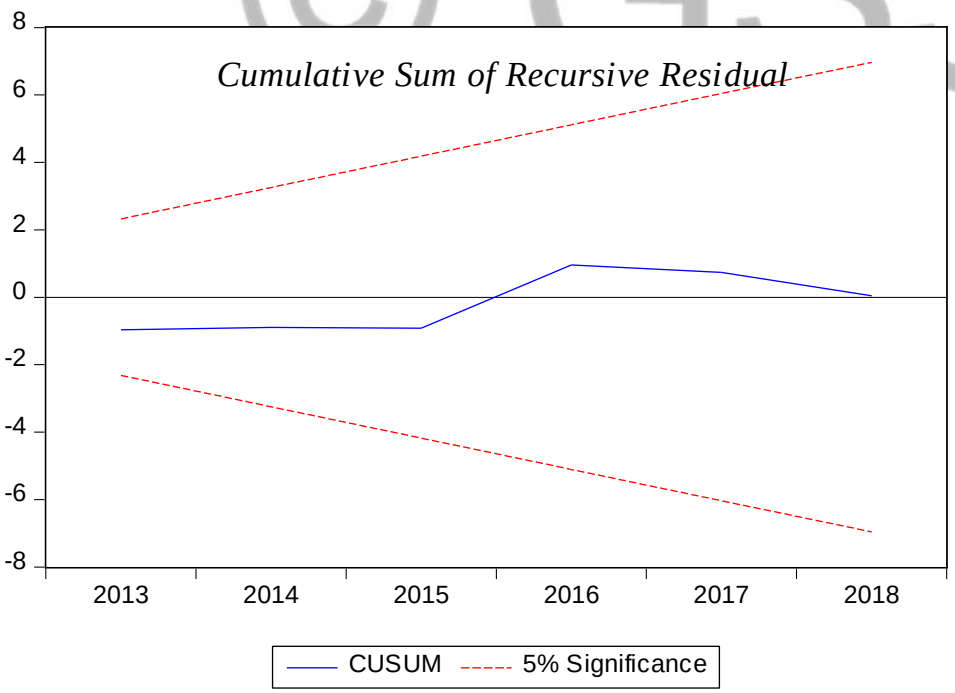
F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.801507	10%	2.38	3.45
K	7	5%	2.69	3.83
		2.5%	2.98	4.16
		1%	3.31	4.63
			Finite Sample: n=35	
Actual Sample Size	28			
		10%	2.729	3.985
		5%	3.251	4.64
		1%	4.459	6.206
			Finite Sample: n=30	
		10%	2.843	4.16
		5%	3.394	4.939
		1%	4.779	6.821

APPENDIX 6: DIAGNOSTICS TESTS

Stability analysis





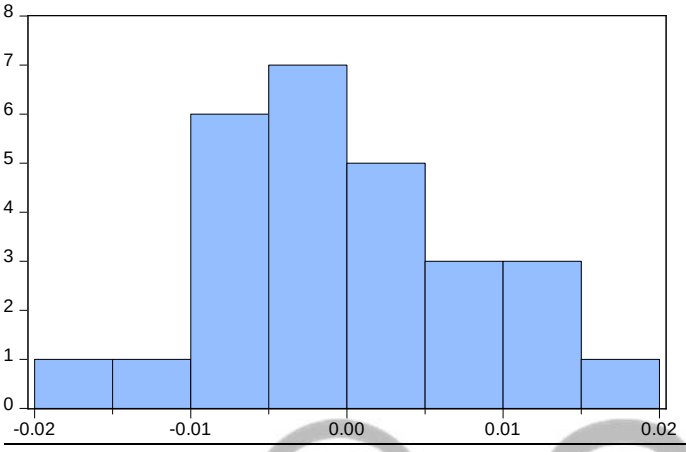
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.804245	Prob. F(19,7)	0.6714

Obs*R-squared	18.51731	Prob. Chi-Square(19)	0.4882
Scaled explained SS	1.146735	Prob. Chi-Square(19)	1.0000

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.988154	Prob. F(2,17)	0.3927
Obs*R-squared	3.853405	Prob. Chi-Square(2)	0.1456



Series: Residuals	
Sample 1992 2018	
Observations 27	
Mean	3.21e-15
Median	-0.000202
Maximum	0.018276
Minimum	-0.018246
Std. Dev.	0.008390
Skewness	0.064791
Kurtosis	2.842667
Jarque-Bera	0.046739
Probability	0.976902

UNIT ROOT TEST OF ECM

Null Hypothesis: ECM has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.867347	0.0000
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: ECM has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 25 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-27.99549	0.0000
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	7.67E-05
HAC corrected variance (Bartlett kernel)	4.61E-06

Null Hypothesis: ECM is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.257785
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000106
HAC corrected variance (Bartlett kernel)	7.40E-06

APPENDIX 7: ERROR CORRECTION PRESENTATION

ARDL Error Correction Regression
Dependent Variable: D(LRGDP)
Selected Model: ARDL(2, 2, 2, 0, 2, 1, 1, 2)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 06/11/20 Time: 17:37
Sample: 1990 2019
Included observations: 28

ECM Regression
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.70938	1.266954	-10.03144	0.0001
@TREND	-0.066234	0.006653	-9.955285	0.0001
D(LRGDP(-1))	-0.340410	0.064446	-5.282127	0.0019
D(LRE)	0.040352	0.015576	2.590618	0.0412
D(LRE(-1))	-0.078076	0.016796	-4.648494	0.0035
D(LAID)	0.029533	0.010950	2.697077	0.0452
D(LAID(-1))	-0.449515	0.074647	-6.021906	0.0009
D(LFDI)	0.077147	0.007816	9.870910	0.0002
D(LDBT)	-0.047631	0.020393	-2.335654	0.0212
D(LDBT(-1))	0.088881	0.032303	2.751473	0.0332
D(LGCF)	1.171149	0.058478	20.02729	0.0000
D(LOP)	-0.218551	0.086658	-2.522005	0.0452
D(LUR)	-0.729354	0.140749	-5.181943	0.0021
D(LUR(-1))	-0.342753	0.115020	-2.979941	0.0246
CointEq(-1)*	-0.906688	0.120333	-7.534824	0.0001

R-squared	0.973158	Mean dependent var	0.000161
Adjusted R-squared	0.956315	S.D. dependent var	0.080966

S.E. of regression	0.014860	Akaike info criterion	-5.274125
Sum squared resid	0.002871	Schwarz criterion	-4.602209
Log likelihood	85.20068	Hannan-Quinn criter.	-5.074329
F-statistic	58.37381	Durbin-Watson stat	3.072632
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	8.801507	10%	2.38	3.45
K	7	5%	2.69	3.83
		2.5%	2.98	4.16
		1%	3.31	4.63

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-10.02793	10%	-3.13	-4.53
		5%	-3.41	-4.85
		2.5%	-3.65	-5.14
		1%	-3.96	-5.49