The Impact of Foreign Aid, Trade Balance, and Remittance on Economic Growth in Ethiopia: Application of Autoregressive Distributed Lag Model

Murad Mohammed Baker

Department of Statistics, Haramaya University, P.O Box 138, Dire Dawa, Ethiopia

Abstract

Background: Economic growth is profoundly affected by inflow of foreign capital (foreign aid, foreign investment, and personal remittances). Ethiopia's economy has declined from time to time due to the variations in foreign aid, trade balance, remittances, etc. Therefore, it is necessary to elucidate the impact of capital inflow on economic growth of the country to handle the variation and mitigate its negative effect on development.

Objective: The objective of the study was to examine the impact of foreign aid, trade balance, and remittance on economic growth in Ethiopia in the short-run and long-run.

Materials and Methods: This study adopted yearly time series data from 1981 to 2021 to estimate Autoregressive Distributed Lag (ARDL) model. To estimate the model, a Dickey Fuller test was applied using generalized least squares. The bound tests for co-integration were used to scrutinize the long-run relationships between the variables.

Results: The results of the study revealed that unexpected shocks in foreign aid, trade balance, remittance and trade openness have had a negative impact on economic growth while unexpected shocks in government expenditure will have significant positive effects on economic growth in the long-run. The lagged error-correction term indicated the system corrects its previous period disequilibrium at the adjustment speed of 52.21% yearly in the long-run.

Conclusion and Implications: The short run changes in remittances have strong and significant impacts on economic growth in the long run. Foreign aid affects economic growth negatively and positively in the long run and short run respectively. This implies that 1% increase in foreign aid causes a 0.017% decline in economic growth of the country in the long run and 1% increase in foreign aid of the country contributes a 0.025% increase to economic growth of the country in the short run. The short run changes in trade balance will have strong and significant impacts on economic growth in the long run. This implies that the government should formulate various systems and raise consciousness on both remittances receivers and senders regarding the use of money to raise savings and businesses to increase fixed investment in the long run. Moreover, the government should focus on the production of domestic commodities to reduce remittances and foreign aid from other countries and increase the yield of export commodities to raise the export performances of the country.

Keywords: Autoregressive Distributed Lag (ARDL); Economic growth; Ethiopia; Foreign Aid; Remittance; Trade balance

1. Introduction

The achievement in economic growth is highly affected by the inflow of foreign aid in several sub-Saharan African (SSA) countries (Bewket Aschale, 2022; Haile Girma, 2015). The evidence from SSA indicates that all three forms of foreign capital inflows (foreign aid, foreign direct investment, and personal remittances) have positive and significant impacts on economic growth in the long run (Olayungbo and Quadri, 2019). Ethiopia is one of the major recipients of international aid from different countries and organizations. However, it is obvious that despite notable supporter involvement in the economic activities, low economic growth and poverty has persisted for long. Thus, foreign aid could have a negative impact on economic growth both in the short run and in the long run (Haile Girma, 2015; Nkoro and Uko, 2016; Karamuriro *et al*., 2020). The negative and significant error correction term shows that the short run disequilibrium adjusts to its long run equilibrium by 84.6% each year (Nkoro and Uko, 2016). In Ethiopia, nowadays, foreign aid flow is significantly increasing; but, results from most country-specific studies have revealed that the flow of foreign aid has had

*Corresponding Author: murt.stat@gmail.com

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a negative effect on the economic growth of Ethiopia in the long run (Kirikkaleli *et al.,* 2021).

Trade balance is a central component playing a significant role in the Gross Domestic Products (GDP) of a country. As the trade surplus rises, the GDP of a country increases which implies exports of goods and services increases whereas imports of goods and services decline (Kira, 2013). Ethiopia runs steady trade deficits due to slight production of exportable goods and logistic difficulties (Tekeba Eshetie *et al.,* 2018). The main exports in Ethiopia are gold, coffee, live animals, and oilseeds while the main imports are fuel, textile apparel, and foodstuffs (Mandefrot Amare *et al.,* 2022). Ethiopia's trade balance for 2021 was –10.09 billion dollars, which only slightly declined from the amount it was in 2020, which was –10.50 billion dollars (Atnafu Gebremeskel, 2022). The deterioration of trade balance reduces the average economic growth of one country, implying that the deterioration in trade balance has a negative impact on economic growth in the presence of a large trade deficit in the long run and in the short run (Blavasciunaite *et al.,* 2020).

Currently, due to the consequences of the COVID-19 pandemic, political instability, and civil strife, climate-related problems, and the Russian-Ukraine war, fuel prices have soared in Ethiopia (Bruk Alemu, 2022; Hassen and Bilali, 2022). According to International Monitory Fund (IMF) (2021), Ethiopia is facing an obvious economic slowdown and a deficit in its trade balance. To address this urgent necessity, the IMF authorized US$411 million in emergency assistance for Ethiopia under the Rapid Financing Instrument (IMF, 2021). Ethiopia was running with a negative trade balance in the last three decades, indicating that foreign currency earnings from exports have been insufficient for covering the expenditures on imports (Akshaya, 2018). A study conducted in Somalia showed that the trade balance has a negative relationship with the real GDP in the short run and in the long run (Ahmed Abdulle, 2022).

The three identified theories to explain the flow of remittance are Pure Altruism, Pure Self-Interest, and Tempered Altruism which is also referred to as Enlightened Self-Interest (Lucas and Stark, 1985). Most discussions in the literature are centered on the first two theories. These theories illustrate that remittances are sent mainly as a result of pure altruistic and self-interest motives. The motive of pure altruism which is also known as moral altruism, consists in helping someone else, even when it is dangerous, without any repayment (Abounader, 2018) whereas the self-interest motive is a concern for a particular advantage and well-being acted out of self-interest and fear (Reda and Reda, 2018).

Currently, remittance has soared in a momentous way in emerging countries. There are two distinct opinions on the impact of remittance on economic growth, optimist and pessimist opinions. The optimists' opinion approve that remittances have a positive impact on the remit-gaining country through reducing poverty and inspiring economic growth whereas the pessimists' opinion explains remittances as hurting economic growth through increasing dependency on remittances by receiving countries (Tassew Dufera and Nandeeswar, 2016). Previous studies conducted in Ethiopia showed that remittances have positive impact on economic growth in the short run but a negative impact in the long run (Tassew Dufera and Nandeeswar, 2016; Debelo Bedada and Fetene Bogale, 2022).

A number of other studies in other countries have revealed the impact of foreign aid, trade balance, and remittance on economic growth (Trinh, 2014; Adusah-Poku, 2016; Aghoutane and Karim, 2017; Olayungbo and Quadri, 2019; Edward and Karamuriro, 2020; Blavasciunaite *et al*, 2020; Ekanayake and Moslares, 2020; Oteng-Abayie *et al*, 2020; Zobair, 2021). However, no such multi-dimensional studies have been conducted in Ethiopia so far. Thus, this study was aimed at investigating the impact of foreign aid, trade balance, and remittance on economic growth in Ethiopia. Ethiopia's economic growth has declined through time to time due to various macroeconomic variables. The research questions for this study were what is the relationship between economic growth and its selected macroeconomic variables in the long run and in the short run? How did foreign aid, trade balance, and remittance affect economic growth in Ethiopia? What are the direction, magnitude, and persistence of economic growth in relation to foreign aid, trade balance, and remittance? The specific objective of this study was to analyze the short run and long run impact of foreign aid, trade balance, and remittance on economic growth in Ethiopia using the data spanning from 1981 to 2021 by applying the Autoregressive Distributed Lag (ARDL) model.

2. Materials and Methods

2.1. Data Source

In this study, the annual time series data on gross domestic product (GDP) as a proxy to economic growth, foreign aid (FA), the trade balance (TB) and remittance (REM) as well as controlling factors: trade openness (TO) and government expenditure (GE) during 1981 to 2021 were taken from the various organization. The data on GDP per capita, trade balance, remittance, trade openness and government expenditure were extracted from the World Development Indicators (WDI) database whereas the data on foreign aid was extracted from the Food and Agriculture Organization Statistics (FAOSTAT) database.

Table 1. Description of variables.

Variable	Description	Prior expectation	Unit of measurement
GDP	Measured as aggregate output		In billion dollar
FA	Measured as the net disbursement amount of ODA	+/–	In billion dollar
REM	Measured as the sum of money and the monetary value of goods received from migrant workers abroad	+/–	In million dollar
TB	Measured as the ratio of exports to imports	+/–	In billion dollar
TO	Measured as the ratio of exports plus imports over GDP	–	In million dollar
GE	Measured as expenditure per capita	+	In billion dollar

Note: *GDP = Gross Domestic Product; FA = Foreign Aid; REM =s Remittance; TB = Trade Balance; TO is Trade Openness; GE = Government Expenditure; and ODA = Official development assistance.*

2.2. Solow Growth Model

The Solow Growth Model, developed by economist Robert Solow, was the first neoclassical growth model and was built upon the Keynesian Harrod-Domar model (Solow, 1956). The neoclassical Solow type aggregate production function remains the most relevant model used to examine the relationship between economic growth and its determinants. This study followed the empirical aggregate production function specifications in Oteng-Abayie *et al.* (2020), Kumar *et al.* (2017), and Frimpong and Oteng-Abayie (2006) to examine the effect of foreign aid, trade balance and remittance on economic growth, controlling for other factors as follows:

$$Y_t = F(K_t, L_t, A_t) \quad (1)$$

Where, Y_t represents the total output measured by GDP per capita, K_t represents the units of capital proxy for gross fixed capital formation, and L_t represents the units of labor. The production function can be stated in intensity form as a ratio of labor units:

$$GDP_t = f(k_t, A_t) \quad (2)$$

Where, GDP_t and K_t are GDP per capita and the units of capital proxy for gross fixed capital formation respectively. However, A_t is an index of total factor productivity, which captures other sources of economic growth not explained persistently by the function in equation (2). It is presumed that foreign aid, trade balance, remittance, and the other control factors affect economic growth through A_t. The total factor productivity as a function of foreign aid (FA), trade balance (TB), remittances (*R*EM), trade openness (TO), and government expenditure (GE). The functional form is specified as:

$$A_t = h(FA_t, TB_t, REM_t, TO_t, GE_t) \quad (3)$$

Substituting equation (3) into equation (2), can be write as:

$$GDP_t = f(k_t, FA_t, TB_t, REM_t, TO_t, GE_t) \quad (4)$$

The precise estimable econometric equation is written in a log-linearized form as

$$\ln GDP_t = \beta_0 + \beta_1 \ln K_t + \beta_2 \ln FA_t + \beta_3 \ln TB_t + \beta_4 \ln REM_t + \beta_5 \ln TO_t + \beta_6 \ln GE_t + \varepsilon_t \quad (5)$$

Where, ε_t is the stochastics disturbance term and β_0, β_1, β_2, β_3, β_4, β_5, and β_6 are the parameters, $\ln GDP_t$ is the natural log of real Gross domestic product which is measures the value of the goods and services produced by an economy in a specific period, adjusted for inflation and is used as a proxy to measure economic growth (as the dependent variable).

$\ln FA_t$ is a log of foreign aid. Foreign aid stimulates economic growth by supplementing domestic sources of finance such as savings; increasing physical and human

capital investment; increasing the capacity to import capital goods and technology (Azam and Feng, 2022) while foreign aid reduces economic growth by attacking the country through increasing dependency on donor countries, increasing economic and political pressure on the receiving country, benefiting large-scale agricultural projects and not benefiting less privileged small farmers who need most assistance (Thapa, 2020). Therefore, foreign aid affects economic growth positively or negatively.

$lnTB_t$ is a log of a trade balance which is the difference between the value of a country's exports and imports for a given period. A country that imports more goods and services than it exports in terms of value has a trade deficit while a country that exports more goods and services than it imports has a trade surplus (Kira, 2013). Therefore, trade balance affects economic growth positively or negatively.

$lnREM_t$ is a log of remittances. Total remittance inflow is taken to measure the number of money countries received from their citizen living abroad (Zobair, 2020). Therefore, remittance has an impact on the economic growth of the country regardless of its direction which means it affects economic growth positively or negatively.

$lnTO_t$ is a log of trade openness. Trade openness is defined as the ratio of exports plus imports over GDP (Bunje *et al*., 2022). In the country having low financial development, openness to trade has negative impact on economic growth, but has insignificant impact on growth in high financial development countries (Mohamed Sghaier, 2021) while trade openness is favorable to economic growth in low-inflation countries, but has insignificant impact on growth in high-inflation countries (Keho, 2017). Therefore, trade openness affects economic growth of Ethiopia negatively.

$lnGE_t$ is a log of government expenditure. Government expenditure refers to the purchase of goods and services, which include public investment and public consumption, and capital transfer and transfer payments consisting of income transfers (pensions, social benefits) (Garry and Rivas, 2017). Government expenditure affect economic growth positively.

2.3. Econometric Model Specification

Econometricians and other scholars have developed several methods to conduct time series analysis. To prevent the emergence of spurious results, a unit root test was carried out in order to test for stationarity and to determine the order of integration. Dickey-Fuller (DF) test using generalized least squares (GLS) test of stationarity, which was developed by Elliott *et al.* (1992), was employed, all the variables entered in the regression should be integrated; either order zero (I(0)); order one (I(1)) or a mixture of order zero (I(0)) and order one (I(1)), but not any order two (I(2)) appear in the series (Wei, J., 2014). While a co-integration test was carried out to detect if there exists the long-run relationship between trade balance, foreign aid, and remittance with Economic growth in Ethiopia. The most commonly used methods to test for the presence co-integration among the series are Engle and Granger (1987) test and the maximum likelihood based on Johansen (1991) and Johansen and Juselius (1990) tests. However, as these approaches demand all variables to have the same order of integration, the latest ARDL methodology, which can be used to test for co-integration of the series with mixed order integration, was selected to test the presence of the long-run relationship between the variables in this study.

2.3.1. Autoregressive distributed lag (ARDL) model

The paper implemented the Autoregressive Distributed Lag (ARDL) bound test used widely by Pesaran and Pesaran (1997); Pesaran and Smith (1998) and Pesaran *et al.* (2001). This method has a number of advantages over Johansen co-integration techniques. First, the ARDL model is the supreme useful method of determining the presence of co-integration in small samples. The second advantage of ARDL approach is that the ARDL approach can be practiced whether the variables in the regression are purely of I (1) and/or purely I (0) or a mixture of both while other co-integration techniques require all of the regressors to be of the same order. This indicates that the ARDL approach evades the pre-testing difficult related with standard co-integration, which requires that the variables be already categorized into I (1) (Pesaran *et al*., 2001).

Thirdly, the ARDL approach to co-integration is desirable to the Johansen approach because it evades the problem of too many selections that are to be prepared in Johansen method. These comprise the treatment of deterministic features, the order of VAR and the optimal lag length to be used. Finally, in the ARDL approach variables could have varies lag length, whereas in the Johansen method this is not allowable. Furthermore, through a simple linear transformation, a dynamic Error

Correction Model (ECM), which can integrate the short-run dynamics with the long-run equilibrium without losing the long-run information, can be derived from ARDL (Pesaran *et al.*, 2001). It is argued that the problems resulting from non-stationary time series data can be avoided using the ARDL approach (Laurenceson and Chai, 2003).

To examine the existence of the short-run and long-run relationship, the general version of the ARDL (p, q) model can be written as follows:

$$\begin{aligned}\ln GDP_t &= \alpha_0 + \beta_0 \ln GDP_{t-1} + \ldots\ldots + \beta_p \ln GDP_{t-p} + \gamma_{10} \ln K_t + \ldots\ldots + \gamma_{1q} \ln K_{t-q} \\ &+ \gamma_{20} \ln FA_t + \ldots\ldots + \gamma_{2q} \ln FA_{t-q} + \gamma_{30} \ln TB_t + \ldots\ldots + \gamma_{3q} \ln TB_{t-q} \\ &+ \gamma_{40} \ln REM_t + \ldots\ldots + \gamma_{4q} \ln REM_{t-q} + \gamma_{50} \ln TO_t + \ldots\ldots + \gamma_{5q} \ln TO_{t-q} \\ &+ \gamma_{60} \ln GE_t + \ldots\ldots + \gamma_{6q} \ln GE_{t-q} + u_t\end{aligned} \tag{6}$$

The model in equation (6) is said to be "autoregressive" since it includes p lags of the dependent variable and it is also a "distributed lag" model because it includes q lags of explanatory variables. Equation (6) can be summarized as follows by taking some mathematical techniques.

$$\begin{aligned}\Delta \ln GDP_t &= \alpha_0 + \sum_{i=1}^{p} \delta_i \Delta \ln GDP_{t-i} + \sum_{i=1}^{q} \beta_{1i} \Delta \ln K_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta \ln FA_{t-i} + \sum_{i=1}^{q} \beta_{3i} \Delta \ln TB_{t-i} \\ &+ \sum_{i=1}^{q} \beta_{4i} \Delta \ln REM_{t-i} + \sum_{i=1}^{q} \beta_{5i} \Delta \ln TO_{t-i} + \sum_{i=1}^{q} \beta_{6i} \Delta \ln GE_{t-i} + \lambda_1 \ln GDP_{t-1} + \lambda_2 \ln K_{t-1} \\ &+ \lambda_3 \ln FA_{t-1} + \lambda_4 \ln TB_{t-1} + \lambda_5 \ln REM_{t-1} + \lambda_6 \ln TO_{t-1} + \lambda_7 \ln GE_{t-1} + u_t\end{aligned} \tag{7}$$

In equation (7), the terms with the summation signs represent the error correction dynamics and α_0, δ_i, β_{1i}, β_{2i}, β_{3i}, β_{4i}, β_{5i}, and β_{6i} are coefficients that measure the short-run relationship while λ_1, λ_2, λ_3, λ_4, λ_5, λ_6, and λ_7 are coefficients that measure the long-run relationship. Equation (7) takes three steps in examining the relationship: Firstly, test for the non-existence of I (2) or above for explanatory variables and test for the existence of the long-run relationship. Secondly, examine the long-run relationship. Thirdly, examine error correction model estimation.

2.3.2. Bound tests for co-integration

Even if the ARDL approach does not require the integration of the same order for all explanatory variables in the equation, it pre-requisites for a test of the non-existence of all explanatory variables with the integration of order two I (2) or above to avoid the possibility of spurious regression and invalid F-statistics computed (Pesaran, *et al.*, 2001). If the variables are found I (0), I (1) or mutually integrated, the first step in the ARDL approach is to test whether there is the long-run relationship between the variables or not. Bounds test for co-integration was carried out as proposed by Pesaran, *et al.* (1999) and Pesaran *et al.* (2001).

The test hypothesis is shown below:

H_0: $\lambda_1=\lambda_2=\lambda_3=\lambda_4=\lambda_5=\lambda_6=\lambda_7=0$ ……. there is no long-run relationship among the variables.

H_1: $\lambda_1\neq\lambda_2\neq\lambda_3\neq\lambda_4\neq\lambda_5\neq\lambda_6\neq\lambda_7\neq0$ …….. there is a long-run relationship among the variables.

Non-standard F-statistics critical values are provided to test these hypotheses. For this test, the critical values of the F-statistics are accessible in Pesaran *et al.*, (2001) whereas the critical values of Narayan (2005) also estimated by quarreling the critical values supplied by Pesaran *et al.* (2001) are suitable for comparatively large sample sizes. He supposed that using such critical values for small sample size may yield deceptive results. As a result, Narayan (2005) has produced a different set of critical values for small sample sizes ranging from 30 to 80 observations based on analogous GAUSS code which was engaged by Pesaran *et al.*, (2001). They offer two sets of critical values, namely the lower bound values and the upper bound values.

If the F-statistic exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected regardless of whether the underlying orders of integration of the variables are I(0) or I(1). Similarly, if the F-statistic falls below the lower critical value, the null

hypothesis is not rejected. However, if the F-statistic falls between these two bounds, the result is inconclusive. When the order of integration of the variables is known and all the variables are I(1), the decision is made based on the upper bounds. Similarly, if all the variables are I(0), then the decision is made based on the lower bound.

Once the co-integration is confirmed, the second stage in ARDL is an estimation of long-run coefficients and the conditional ARDL long-run model can be estimated as:

$$\Delta \ln GDP_t = \alpha_0 + \sum_{i=1}^{p} \delta_i \ln GDP_{t-i} + \sum_{i=1}^{q} \beta_{1i} \ln K_{t-i} + \sum_{i=1}^{q} \beta_{2i} \ln FA_{t-i} + \sum_{i=1}^{q} \beta_{3i} \ln TB_{t-i} + \sum_{i=1}^{q} \beta_{4i} \ln REM_{t-i} + \sum_{i=1}^{q} \beta_{5i} \ln TO_{t-i} + \sum_{i=1}^{q} \beta_{6i} \ln GE_{t-i} + u_t \quad (8)$$

The third stage entails the estimation of the error correction equation using the differences of the variables and the lagged long-run solution and determines the speed of adjustment of returns to equilibrium.

$$\Delta \ln GDP_t = \alpha_0 + \sum_{i=1}^{p} \delta_i \Delta \ln GDP_{t-i} + \sum_{i=1}^{q} \beta_{1i} \Delta \ln K_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta \ln FA_{t-i} + \sum_{i=1}^{q} \beta_{3i} \Delta \ln TB_{t-i} + \sum_{i=1}^{q} \beta_{4i} \Delta \ln REM_{t-i} + \sum_{i=1}^{q} \beta_{5i} \Delta \ln TO_{t-i} + \sum_{i=1}^{q} \beta_{6i} \Delta \ln GE_{t-i} + \lambda_1 \ln GDP_{t-1} + \lambda_2 \ln K_{t-1} + \lambda_3 \ln FA_{t-1} + \lambda_4 \ln TB_{t-1} + \lambda_5 \ln REM_{t-1} + \lambda_6 \ln TO_{t-1} + \lambda_7 \ln GE_{t-1} + \partial ECM_{t-1} + u_t \quad (9)$$

Where, ∂ is the speed of adjustment parameter and ECM_{t-1} is an error correction term lagged by one period. The term ECM is derived as the error term from the corresponding long-run model whose coefficients are obtained by normalizing the equation. Diagnostic tests are applied to detect serial correlation, heteroscedasticity, and conflict with normality. The stability of short-run and long-run coefficients is tested by employing cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) tests. The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the breakpoints. If the plots of CUSUM and CUSUMSQ statistics stay within the critical bounds of 5% level of significance, the null hypothesis of all coefficients in the given regression is stable and cannot be rejected.

3. Results and Discussion

3.1. Descriptive Statistics

To achieve the research aims, the yearly data spanning from 1981 to 2021 in Ethiopia was examined. In this study, diverse econometric models were engaged to analyze the impact of trade balance, foreign aid and remittance on economic growth in Ethiopia. Some descriptive statistics including mean, standard deviation, minimum and maximum values of the series were computed (Table 2).

Table 2. Descriptive statistics of the variables in the study.

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	41	27.470	29.041	6.928	111.27
FA	41	1.122	0.787	0.104	2.419
REM	41	0.252	0.371	0.005	1.796
TB	41	–166.930	231.309	–729.249	32.519
TO	41	223.085	80.140	95.692	366.056
GE	41	10.314	6.124	3.596	30.812

Note*: GDP = Gross Domestic Product; Obs = Observations; Std.Dev. = Standard Deviation; Min = Minimum value; and Max = Maximum value.*

The average gross domestic product covering the years from 1981 to 2021 in Ethiopia was worth 27.47 billion dollars whereas the minimum and maximum values were 6.928 billion dollars and 111.27 billion dollars over a 41-year period, respectively (Table 2). The reason for the minimum GDP was that, political instability, poverty and drought were experienced in Ethiopia. Furthermore, the average foreign aid was 1.12 billion dollars as well as the minimum and maximum values were 0.1 and 2.4 billion dollars, respectively. On average, the remittance over the 41-year period was 0.252 million dollars whereas the minimum and maximum amounts of remittance from abroad were 0.005 million dollars and 1.796 million dollars, respectively. The average trade balance, trade openness and government expenditure were –166.93 million dollars, 223.08 billion dollars and 10.31 billion dollars, respectively over the 41-year period.

3.2. Unit Root Test

Before testing co-integration, all the series were tested for stationarity. To realize the unit root test, DF-GLS test was employed. As depicted in Table 3, first, tested at the level and then it was tested at their first differences. The result showed that order one [I (1) but not order two I (2)] appear. The unit root test results in Table 3 approves that all of the variables were stationary in their first difference on a 1% significance level. This showed that the null hypothesis of non-stationarity was not rejected for all variables at the level because they were stationary on their first difference. Therefore, nothing can forfeit us from using the ARDL approach (bounds test approach of co-integration) developed by Pesaran *et al.* (2001).

Table 3. Dickey-Fuller-GLS unit root test.

Variable	Lag		DF-GLS test at level t-statistic	DF-GLS test at 1st difference t-statistic
GDP	DF-GLS test statistic		–0.247	–3.701
	test critical values	1% level	–2.627	–2.644
		5% level	–1.949	–1.952
		10% level	–1.611	–1.610
K	DF-GLS test statistic		–1.000	–3.116
	test critical values	1% level	–2.644	–2.644
		5% level	–1.952	–1.952
		10% level	–1.610	–1.610
FA	DF-GLS test statistic		–0.998	–2.703
	test critical values	1% level	–2.625	–2.628
		5% level	–1.949	–1.950
		10% level	–1.611	–1.611
TB	DF-GLS test statistic		–1.452	–7.149
	test critical values	1% level	–2.628	–2.628
		5% level	–1.950	–1.950
		10% level	–1.611	–1.611
RE	DF-GLS test statistic		–0.333	–6241
	test critical values	1% level	–2.625	–2.627
		5% level	–1.949	–1.949
		10% level	–1.611	–1.611
TO	DF-GLS test statistic		–1.271	–7.443
	test critical values	1% level	–2.625	–2.627
		5% level	–1.949	–1.949
		10% level	–1.611	–1.611
GE	DF-GLS test statistic		–1.359	–3.964
	test critical values	1% level	–2.634	–2.634
		5% level	–1.951	–1.951
		10% level	–1.610	–1.610

Note: *DF-GLS = Dickey-Fuller test by Generalized Least Squares test.*

3.3. Long-run ARDL Bounds Tests for Co-integration

The next step was to test for the existence of long-run relationships among the variables. The bound test for co-integration was run to check the joint significance of the coefficients in the specified conditional ARDL model. The F-test was conducted for imposing restrictions on the estimated long-run coefficients of all lagged level variables

Table 4. Bound test and critical value.

Test statistic	Value	Statistical significance level	Bounds critical values			
			Based on Pesaran *et al.* (2001) value*		Based on Narayan (2005) value**	
			I(0)	I(1)	I(0)	I(1)
		1%	2.793	3.678	2.793	3.678
F-statistic	17.514	5%	3.156	4.087	3.156	4.087
		10%	3.653	4.664	3.653	4.664

Note: ** and ** indicate that Source from Pesaran et al., (2001) critical values for bound test and Source from Narayan (2005) critical values for the bound test, respectively.*

The value of F-statistic was higher than the upper bound critical value of Pesaran *et al.* (2001) and Narayan (2005) at 1% level of significance (Table 4). This implies that the null hypothesis of no co-integration can be rejected at 1% level of significance and therefore, there was evidence for a long run relationship between economic growth and all explanatory variables. These explanatory variables are foreign aid, the balance of payment, remittance, trade openness, and government expenditure in the model.

3.4. Lag Order Selection Criteria

Choosing a suitable lag length of the variables had robust inferences for successive modeling. The likelihood ratio (LR), Akaike information criterion (AIC), Bayesian information criterion (BIC), and Hannan-Quin information criteria (HQIC) were employed in order to determine the optimal number of lags to be included in the conditional ARDL model (Table 5). So a maximum appropriate lag order of two was chosen in determining the conditional ARDL model as these were selected by the majority of the criterion.

Table 5. Optimal lag selection criteria.

Lag	LL	LR	FPE	AIC	HQIC	BIC
0	12.701	NA	0.043	–0.308	–0.201	–0.003
1	31.735	38.069	0.016	–1.283	–1.160	–0.935
2	36.132	8.794*	0.014*	–1.467*	–1.328*	–1.075*
3	36.419	0.575	0.014	–1.428	–1.274	–0.993
4	36.598	0.356	0.015	–1.384	–1.215	–0.905

Note: *LL = lag length; LR = Likelihood ratio; FPE = Final Prediction Error; AIC = Akaike information criterion; HQIC = Hannan-Quinn information criterion; BIC = Bayesian information criterion; and *indicates lag order selected by the criterion.*

3.5. Long run Model Estimation

After confirming the existence of the long-run relationship between variables and optimal lag order selection, the next step in ARDL was to estimate the long-run coefficients. The long-run relationships between the variables were estimated and the result is reported in Table 6. The R-squared value of the estimated model revealed that 99.7% of the variation in GDP was substantially explained by the variables included in the model. The F-statistic, also, indicated that the overall model was statistically significant. Since the Durbin Watson statistic was also near to two and greater than the upper critical value of the DW-test, there was no spurious relationship between the variables (there was no serial autocorrelation).

Table 6. Estimated Long-run coefficients using the ARDL (1,0,0,1,1,2,0) approach.

Variable	Coefficient	Std. error	t-statistic	*P-value*
GDP(–1)	0.778	0.079	9.808	0.000
K	0.004	0.004	1.162	0.259
FA	–0.017	0.032	–0.551	0.007
TB	–0.015	0.014	–1.081	0.052
TB(–1)	–0.029	0.014	–2.058	0.002
REM	–0.018	0.031	–0.583	0.066
REM(–1)	0.074	0.036	2.025	0.555
TO	–0.142	0.114	–1.248	0.003
TO(–1)	–0.252	0.097	–2.604	0.0162
TO(–2)	0.250	0.075	3.321	0.225
GE	0.516	0.131	3.946	0.001
C	–0.650	0.758	–0.858	0.400
R^2	0.997	Mean dependent variable		2.817
Adjusted R^2	0.996	S.D. dependent variable		0.887
S.E. of regression	0.058	Akaike info criterion		–2.581
Sum squared residuals	0.073	Schwarz criterion		–1.965
Log-likelihood	60.457	Hannan-Quinn criteria.		–2.366
F-statistic	634.503	Durbin-Watson stat		2.013
Prob (F-statistic)	0.000			

Note: *GDP = Gross Domestic Product; FA = Foreign Aid; REM = Remittance; TB = Trade Balance; TO = Trade Openness; and GE = Government Expenditure.*

As expected, the estimated coefficients of foreign aid, remittance and trade openness had negative signs while the units of capital, the balance of payment, and government expenditure had positive signs (Table 6). Besides, the lags in economic growth, foreign aid, trade balance, lags in trade balance, remittance, trade openness, lags in trade openness and government expenditure were statistically significant. The estimated long run relationship coefficients reveal that past economic growth had a positive impact on current economic growth and were statistically significant at 1% level of significance (Table 6). The coefficient indicates that by holding other variables remain constant, a 1% increase in the past value of economic growth leads to a 0.778% increase in the current economic growth in the long run. The estimated coefficient also indicates that foreign aid had negative and statistically significant effects on economic growth at 1% level of significance in the long run. A 1% increase in foreign aid, keeping other variables constant, followed an approximately 0.017% decrease in the economic growth of Ethiopia in the long run. These results are reliable based on the results of various scholars (Tesfahun Bitew, 2014; Haile Girma, 2015; Rahnama *et al.*, 2017).

The estimated coefficient of the long run relationship shows that the current and past value of the trade balance negatively affected economic growth in the long run and was found to be statistically significant at 1% and 10% levels of significance, respectively (Table 6). This indicates that the country imported more goods and services than the amounts of goods and services it exported over 1981 to 2021. Holding other variables remain constant, the coefficient of a 0.015 showed a 1% increase in the current trade balance leads to a 0.014% decrease in economic growth in the long run. Moreover, the coefficient 0.029 indicates that a 1% increase in the previous value of the trade balance leads to a 0.029% decrease in economic growth in the long run, keeping other variables constant. This result is consistent with the findings of similar studies done by Blavasciunaite *et al.* (2020) and Ahmed Abdulle (2022), they found that there existed a negative long run relationship between trade balance and Economic growth in Somalia. However, the result of this study contrasts with the findings of Alemayehu Temesgen (2021) that, there is a positive relationship between trade balance and economic growth in Ethiopia. However, the presence of a large trade deficit deteriorates the economic growth in the long run. This implies that the total value of goods and services that domestic producers sell abroad was lower than the total value of foreign goods and services that domestic consumers buy. This might be due to the existence of a number of conflicts and challenges happened in the country which leads the economic growth to be declined in Ethiopia.

Similarly, the estimated coefficient of the long run relationship shows that the remittance had a negative impact on economic growth in the long-run and was found to be statistically significant at 10% level of significance (Table 6). The coefficient of remittance revealed that an increase in remittance by 1% led to a decrease in economic growth by 0.018% in the long-run. This result is consistent with the results of different empirical studies and theoretical arguments. For instance, Jawaid and Raza (2012), Tassew Dufera and Nandeeswar (2016), Oteng-Abayie *et al.* (2020) found that remittance had a negative and statistically significant impact on economic growth in the long run at 5% level of significance. There are different opinions concerning the negative impact of remittance on economic growth in the long-run. One was that remittances have negative correlations with fixed investment in Ethiopia. This might be because the money received in the form of remittance turns to help the society in reducing poverty by spending on daily expenses for consumption of goods and services rather than on constructing fixed investments such as education, land, buildings, technology, etc. (Haile Girma, 2015; Tassew Dufera and Nandeeswar, 2016).

Furthermore, the long run estimation indicated that the current and past value of trade openness had negative and statistically significant effects on economic growth in the long run at 5% level of significance (Table 6). The negative impact of trade openness implies that the country imports more goods and services than it exports. This finding shows importing goods and services is more intense than exporting commodities in the country. This is consistent with the results of empirical studies done by Rasoanomenjanahary *et al.* (2022) who found that the trade openness was negative and significant effect on economic growth at 5% level of significance. However, this result is inconsistent with the findings of by Bakari *et al.* (2022) who reported that the trade openness was positive and significant effect on economic growth at 1% level of significance, which would encourages engaging skilled labour force to contribute to the growth in long run. However, the country was importing more commodities than exporting. Thus, domestic production of goods and services has not reached exports beyond domestic consumption in Ethiopia.

Furthermore, government expenditure had a positive and statistically significant impact on economic growth in the long run over GDP at 1% level of significance. A 1% increase in government expenditure would result in an increase in economic growth by a 0.516% in the long run (Table 6). This shows that the allocation of government budget for infrastructure such as roads, electricity, various market centers, etc. can being able to reduce unemployment rate and poverty rate, so that the economic growth of the country can be increase properly. This result is consistent with the findings of a study conducted by Imoughele and Ismaila (2015), Tassew Dufera and Nandeeswar (2016) who reported a positive and significant impact of total government expenditure on economic growth in the long run at a 1% level of significance.

3.6. Short Run Analysis

After confirming the existence of a long run relationship and estimating coefficients in the ARDL model, the ECM was estimated. The coefficient of determination (R-squared) explains that about 86.6% of the variation in economic growth is explained by the explanatory variables in the short-run model. In addition, the DW statistic does not suggest autocorrelation. The coefficient of the lagged error correction term was statistically significant at 1% level of significance and had the expected negative sign confirming the results of the bounds test for co-integration (Table 7). Its value was found to be –0.522, which implies that the speed of adjustment to equilibrium after a shock was high. This means that approximately, 52.2% of the disequilibrium of the previous year's shock converges back to the long-run equilibrium in the current year.

Table 7. Error Correction representation for the selected ARDL model.

Dependent variable is ΔGDP				
Variable	Coefficient	Std. Error	t-statistic	*P-value*
ΔFA	0.025	0.3256	0.077	0.003
ΔTB	–0.015	0.008	–1.875	0.084
ΔREM	–0.018	0.018	–0.989	0.032
ΔTO	–0.142	0.082	–1.740	0.006
ΔTO(–1)	–0.250	0.056	–4.434	0.000
ΔGE	0.516	0.094	5.502	0.000
EC(–1)	–0.522	0.049	–4.496	0.000
$ECM_{-1} = \Delta GDP - 0.025\Delta FA + 0.015\Delta TB + 0.018\Delta REM + 0.142\Delta TO + 0.25\Delta TO(-1) - 0.516\Delta GE$				
R^2	0.866	Mean dependent variable		0.059
Adjusted R^2	0.844	S.D. dependent variable		0.125
S.E. of regression	0.049	Akaike info criterion		–3.025
Sum squared residuals	0.073	Schwarz criterion		–2.761
Log-likelihood	60.457	Hannan-Quinn criteria.		–2.933
Durbin-Watson stat	2.003			

Note: *EC = Error correction; GDP = Gross Domestic Product; FA = Foreign Aid; REM = Remittance; TB = Trade Balance; TO = Trade Openness; and GE = Government Expenditure.*

The results of foreign aid were different in the short run and in the long run. Foreign aid had a positive and statistically significant impact on economic growth in the short run at a 1% level of significance (Table 7). This indicates that keeping other variables constant, a 1% increase in foreign aid would result in a 0.025% increase in the economic growth of a country in the short run. The results are in line with the findings of Mohapatra *et al.* (2016) who reported the foreign aid was found to have positive and significant effect on economic growth at 5% level of significance in the short run. The result found the short run change is necessary to maintain the long run relationship. However, in this study, short run change was not necessary to maintain the long run relationship which means that foreign aid was negatively affected economic growth in the long run and positively affected economic growth in the short run.

Similarly, the results of the trade balance were similar in both the short run and the long run, which had a negative and significant impact on economic growth. The trade balance had a negative and statistically significant impact on economic growth in the short run at 10% level of significance (Table 7). This shows that holding other variables remains constant, as the trade balance was increased by 1%, leading to a decrease in economic growth by 0.015% in the short run. The result of this study is consistent with the findings of Ahmed Abdulle (2022) that there is a negatively significant relationship between the trade balance and the Economic growth in the short run. This result implies that a 1% increase in the trade deficit leads the real GDP to decrease by 2.89% in the short run.

The results of remittance were similar in both the short run and the long run. Remittances have a negative and statistically significant impact on economic growth in the short run while having negative and significant impact on economic growth at 5% level of significance in the long run (Table 7). This implies that remittances can decrease labor supply and create a culture of dependency that inhibits economic growth. However, this result contrasts with the findings of the study conducted by Abel Tenaye (2019) which revealed that remittance had positive and significant effect on economic growth. This results implies that a 1% change on remittance was associated with a 3.87% increase on real growth rate in the short run. However, the remittances increase the consumption of non-tradable goods in a high price, appreciate the real exchange rate, and decrease exports, thus damaging the competitiveness of the country receiving in world markets in the short run and long run.

The results of trade openness were similar in the short run and the long run, with negative and statistically significant impacts on economic growth. The current and past values of trade openness had a negative and statistically significant impact on economic growth at 1% level significance (Table 7). By keeping other variables constant, increasing the current value of trade openness by 1% reduces economic growth by 0.142% in the short run. Likewise, increasing the past value of trade

openness by 1% level of significance reduces economic growth by 0.250% in the short run. This mainly implies that trade deficit occurs because of a country lacks efficient capacity to produce its own products due to lack of skill and resources to create that capacity and lack of preference to obtain from another country. Hence, the global trade openness forced the country to compete in the same market with the country having stronger economies. This challenge can inhibit established local industries or results in the failure of newly developed industries in the country. This result is consistent with the results of a study conducted by Abel Tenaye (2019) that revealed the openness to trade shows a negative and significant effect on economic growth. A 1% change on openness to trade was associated with a 0.91% decline on real growth rate in the short-run.

Furthermore, the result of government expenditure was similar for the short run and long run which had a positive and statistically significant impact on economic growth at 1% level significance. Government expenditure positively affected economic growth. As government expenditure increased by 1%, increased economic growth by 0.516% over GDP at 1% level significance (Table 7). This implies that increased government expenditure raises aggregate demand and increases consumption, which leads to increased production.

3.7. Diagnostic Test

To check the validity of the estimated long-run model, some diagnostic tests were conducted. There was no error autocorrelation, no heteroscedasticity, and the errors were normally distributed (Table 8). The Ramsey functional form test confirms that the model was specified well. Hence, the relationship between the variables was valid.

Table 8. Long-run diagnostic test.

Test statistics	LM-version	F-version
Normality Test	CHSQ (2) = 3.007(0.248)	Not Applicable
Serial Correlation Test	CHSQ (1) = 0.264(0.608)	F(1,29) = 0.203(0.656)
Heteroscedasticity Test	CHSQ (6) = 7.812(0.252)	F(6,32) = 1.336(0.270)
Functional Form Test	CHSQ (1) = 0.278(0.782)	F(1,31) = 0.189(0.667)

Note: *LM = Lagrangian multiplier test and CHSQ = Chi-square test. The test for normality is based on a test of skewness and kurtosis of residuals; the test for serial correlation is based on the LM test for autocorrelation; and the test for heteroscedasticity is based on the regression of squared residuals on squared fitted values and the test for functional form is Ramsey's RESET test.*

The stability of the long run estimates was confirmed by applying the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) test which were suggested by Pesaran *et al. (*1999). The tests could detect not only their significance but also at what point of time possible instability (structural break) may have happened since the test statistics of the CUSUM stability test could be graphed. Since the plot of CUSUM and CUSUMSQ statistics varies between the critical bounds at the 5% level of significance, then the estimated coefficients are said to be stable. This is consistent with the results of a study done by Fasanya and Olayemi (2018) who found the plot of the cumulative sum and cumulative sum of square, which falls within the boundary of 5% critical value, confirmed the diagnostic tests of long-run estimation, that the coefficients estimated are stable over time.

The straight line in Figures 1 and 2 represent the critical bounds at 5% level of significance. The plot of the cumulative sum test does not cross the lower and upper critical limits (Figure 1). Similarly, Figure 2 shows that the plot of the cumulative sum of squares test does not cross the lower and upper critical limits. Therefore, it is concluded that the long run and short run estimates are stable and there are no structural breaks. Hence, the results of the estimated model are reliable and efficient.

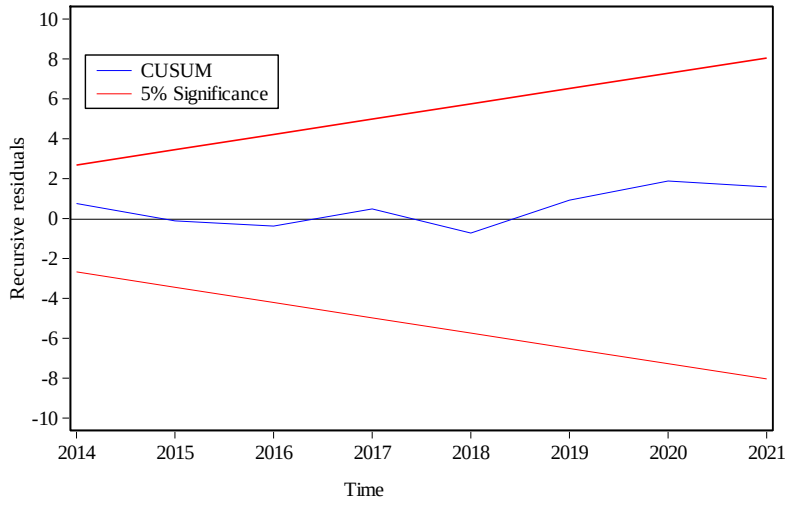

Figure 1. The plot of cumulative sum of recursive residuals.

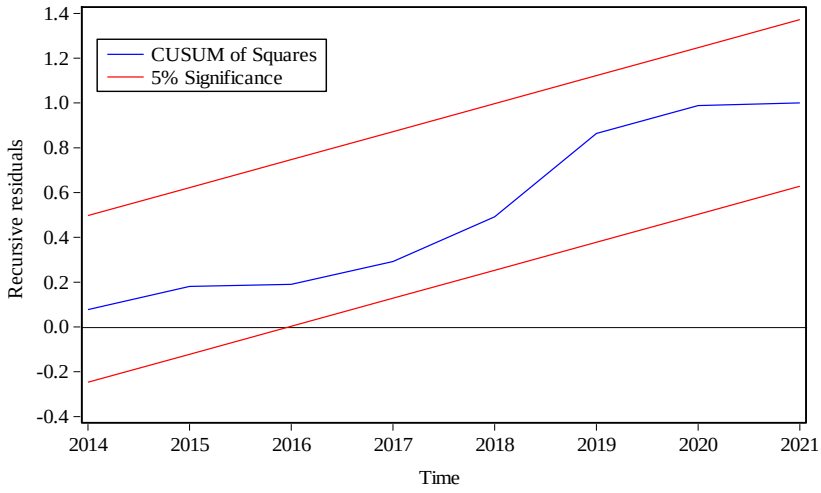

Figure 2. The plot of cumulative sum of squares of recursive residuals.

4. Conclusion and Recommendation

The main purpose of this study was to investigate the impact of foreign aid, trade balance, and remittance on the economic growth of Ethiopia. The study used the time series data extracted from the Food and Agricultural Organization Statistics and World Development Indicators databases spanning from 1981 to 2021. The study employed Autoregressive Distributed Lag Model as a method of data analysis. Economic growth, foreign aid, trade balance, remittance, trade openness, and government expenditure were stationary at first difference and there was long run co-integration among them. The results of the analysis revealed that among the given variables foreign aid, trade balance, remittance, trade openness, and government expenditure had a significant effect on growth both in the short run and in the long run. The findings indicate that foreign aid had a negative and significant effect on economic growth in the long run. However, it had a positive effect in the short run. In the long run, 1% increase on foreign aid of a country causes a 0.017% decline on economic growth while a 1% increase on foreign aid of the country contributes a 0.025% increase on economic growth of the country in the short run. The analysis further revealed that the trade balance had a negative effect in both the long run and the short run. This implies that Ethiopia imports more commodities than it exports. Remittance has a negative effect on economic growth both in the long run and the short run. Similarly, trade openness has a negative effect on economic growth both in the long run and the short run whereas the government expenditure has a positive effect both in the long run and the short run.

Based on the findings of this study, the following policy implications are suggested. The government should create awareness through various channels (media) on courier money receiving and remittance households to increase savings for the opportunity of increasing fixed investments in the long run. Furthermore, the government should focus on producing domestic commodities which can be used for consumption to reduce the volume of foreign aid in the long run as well as encourage production of domestic export commodities to increase exports. Further research should be done to validate these results by adding additional variables which could be considered as determinants of economic growth.

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