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Macroeconomic Determinants of Economic Growth in Ethiopia

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Abstract

This study empirically investigates macroeconomic determinants of long-run economic growth (GDP per capita) of Ethiopia over 1991-2018 periods of EPRDF regime. The study applied ARDL approach to co-integration. The result of the study indicates that there is a stable long-run relationship between GDP per capita, gross capital formation, life expectancy, openness and foreign aid. The estimated long-run result shows that the health human capital has large positive impact on GDP per capita rise followed by gross capital formation. This finding is consistent with the Solow growth and endogenous growth theories. On the other hand, openness and foreign aid have negative effect on the long-run economic growth. The findings of this paper suggest that long-run economic performance of the country can be improved through increasing domestic savings, improving health status of citizens and education quality. Importantly, curtailing overdependence on foreign aid, through increasing internal budget deficit financing mechanisms as well as promoting financial markets development, plays an important role in order to improve the long-run economic growth of the country.

Key Words: 1. Economic growt 2 Health human capital 3. EPRDF 4. ARDL 5. Ethiopia

Introduction

The investigation into macroeconomic factors that drive or hinder economic growth has been one of the central questions of theoretical and empirical economists.In line with finding out what determines economic growth, various disagreeing theories have been emerged. The Solow growth model, which was the first neoclassical growth model and was built upon the Keynesian Harrod-Domar model, affirms that economic growth overtime is determined by population growth rate, the saving rate, and the rate of technological progress(Solow, 1956). However, Solow took all these factors as exogenous and did not explain them at all, which made the theory deficient. The endogenous growth theory modifies the neoclassical growth theory by assuming that long-run economic growth is determined by endogenous technologicalprogress (Romer, 1989). According to the endogenous growth theory, technological progress occurs throughinnovations, which can take place in the form of new products, processes and markets. The Lucas model version of endogenous growth explains that long-run economic growth is the result of human capital accumulation(Lucas , 1988). Playing a dual role in an economy as inputs and outputs, health and education take central importance in deriving economic growth (Todaro, 2014).

According to Acemoglu (2008), it is a combination of technology differences, differences in physical capital per worker and in human capital per workerthat explain the cross-country income differences. However, Acemoglu(2008) explains that these factors fail to provide complete explanation to cross-country income differences. There must be fundamental causes, such as luck, geography, culture and institutions that prevent many countries from investing enough in technology, physical capital and human capital (Acemoglu, 2008).

Furthermore, empirical studies showed that there are enormous determinants of economic growth. Chirwa and Odhiambo (2016) found that in developing countries the key macroeconomic determinants of economic growth include foreign aid, foreign direct investment (FDI), fiscal policy, investment, trade, human capital development,demographics, monetary policy, natural resources, reforms and geographic, regional, political and financialfactors.

In economies of developing countries where saving, foreign exchange and fiscal gaps are highly prevailing, foreign aid plays an immense role in filling these gaps and in accelerating economic growth.It is obvious that developing countries have been receiving large quantities of aid over many decades, but they have failed to transform their economy and trapped in aid-dependent condition. This revealed reality provokes endless debate among economists on the effectiveness of foreign aid in improving economic growth of developing countries. Burnside and Dollar (2000) studied the relationship between foreign aid, policies and economic growth in fifty six developing countries, and found that aid has a positive impact on economic growth in developing countries with good fiscal, monetary, and trade policies but has little effect in the presence of poor policies. Also, their result recommended that aid would be more effective if it were systematically conditioned on good policy.

Another important macroeconomic factor that affects the long-run economic growth of developing countries is foreign direct investment.Mahembe andOdhiambo (2014) reviewed theoretical literature, and showed that FDI affects economic growth of the host country through two broad ways: (i) FDI can encourage the adoption of new technologies in the production process through technological spillovers; and (ii) FDI may stimulate knowledge transfers, in terms of labour training and skill acquisition, and also by introducing alternative management practices and better organizational arrangements. The impacts of FDI on a country's economic growth in the long-run and short-run are different. Interested with this enquiry, Dinh et al. (2019) examined the impact of FDI on economic growth of 30 developing countries, and found that FDI is an important factor for economic growth in the long-run, especially for emerging and developing countries though it can hinder a country's economic growth in the short-run.

The significance of human capital in driving long-run economic growth of developing countries has also been investigated by empirical studies. Investment in human capital boosts productivity through improving quantity and quality of labour force. However, the impact of human capital education economic growth in developing counties is not productive. This is particularly for the educational capital, whereby there is strong association between employment opportunity and level of educational attainment. In developing countries, employers tend to select applicants by level of education even though the job may require no more than a primaryeducation. Thus, the focus on human capital as a driver of economic growth for developing countries led to undue attention on school attainment; rather importance need to be given to the school quality. Hanushek (2013) asserted that without improving school quality, developing countries will find it difficult to improve their long run economic performance. Furthermore, many empirical studies presume that school attainment is the only source of human capital development. However, equally important is the health capital, which is often measured by life expectancy at birth. Kuzne(2014) provided theoretical groundwork for the relationship between life expectancy and economic growth in an overlapping generations model with family altruism where private and public investment in human capital of children are the engine of endogenous growth. Kuzne (2014) explained channels through which life expectancy affects economic growth. First, life expectancy raises the saving rate and thereby increases the rate of physical capital accumulation, which is an important factor in the neoclassical theory of growth. Second, it lowers investments into children's education as old-age consumption becomes relatively more important. Third, it reduces the amount of inheritances parents offer to their children which in turn slows down physical capital accumulation. Fourth, it affects economic growth through the size of public education expenditures because tax rates are increasing functions of life expectancy. Therefore, it is the interaction of these channels that determines the relation between life expectancy and economic growth.

While the theoretical growth theories primarily focus on physical capital accumulation, technological progress and human capital development as determinant of economic growth, the empirical studies indicate that many factors can derive or hinder economic growth. Additionally, the determinants are not equally important in different countries and over different time periods.

The objective of this paper is to investigate the macroeconomic determinants of economic growth in Ethiopia during the last 28 years of Ethiopian People's Revolutionary Democratic Party (EPRDF) regime. The World Bank data (2020) show that the economic growth of Ethiopia has recorded high volatility over the first two decades of EPRDF regime; but it looks more stable in the last decade of the regime. The annual growth rate slowed down and became the largest negative (−11.9 %) in 1992. The year 1992 witnessed new economic reforms, which created large disturbances in the economy (Tada, 2001). On the other hand, Ethiopia' economy has recorded the miracle economic growth in 2004, which was about 10.4% , and growth has been remarkably rapid and stable over 2004-2014 (Word Bank, 2020). However, following the same economic policy over 1991-2018 periods, the country's economic performance has shown different trends. Therefore, it is crucial to investigate the drivers of economic growth in Ethiopia over the past three decades of the EPRDF regime.

Despite the existence of many studies on determinants of economic growth in Ethiopia, they arrived at different conclusions. Geda (2007) investigated sources and determinants of growth in Ethiopia during under Imperial, Derg and EPRDF regimes, in which the scholar found that physical capital, education and residual (total factor productivity) contributed to growth differently under three regimes. Berhanu (2018) conducted qualitative review on existing literatures on the key macroeconomic determinants of economic growth in Ethiopia. The author came across many research studies whose findings reveal that physical capital, foreign aid, external debt, foreign direct investment, demographics, trade, human capital, fiscal policy, monetary policy and financial factors are the significant drivers of economic growth in Ethiopia. Using ARDL approach, Gidey (2015) showed that the ratio of public expenditure on health to GDP (a proxy for health human capital) is the main source of growth in GDP per capita followed education human capital (proxied by secondary school enrollment). Tadesse (2011) did co-integration analysis to examine the effect of foreign aid on economic growth in Ethiopia using a time series data covering the period 1970 to 2009. The author found that foreign aid entered alone has a positive effect on economic growth, but has a significant negative effect on economic growth when it interacts with policy. The overall effect of foreign aid on economic during the periods under study turns out to be negative due to lack of good policies. From the literature survey above, one could notice that various factors can determine economic growth in Ethiopia. However, some studies diverge from theoretical basis, which makes the results soundless.

This study is an attempt to identify determinants of economic growth in Ethiopia following the Solow growth model.

The contribution of this paper is that it disaggregates the effects of human capital on economic growth into education human capital and health human capital effects. In many previous studies, education and health capitals are aggregated as one variable though education and health have different impacts on economic growth. Moreover, this study used mean years of schooling, which is a better measure of educational attainment than the traditional measures, as indicator of education human capital.

Methodology

Theoretical framework and econometric model

The study employed the neoclassical growth model, which is repeatedly applied by most empirical studies. According to the neoclassical growth theory, aggregate output is a function of capital, labour and exogenous technological progress. The aggregate output of an economy can bewritten as follows:

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

where$Y_t$is the aggregate output, Fis the level of the technology that converts capital (K_t),labour (L_t) and total factor productivity (A_t) into aggregate output, and the subscript tdenotes time. Following Solow (1957) and Mankiw et al. (1992), we take the functional form of equation (1) to be a Cobb-Douglas function and write it as follows:

$Y_t = A_t K_t^{\alpha} L_t^{\beta}$ (2)

whereα and β are the shares of capital and labour in output, respectively.

Total factor productivity (TFP) is a coefficient that represents the effect of factors other than labor and capital on the aggregate output. Many empirical literatures, which have focused on growth, showedthat a number of variables affect TFP. Human capital, openness to the world economy, foreign direct investment and foreign aid are the important determinants of TFP (Mankiw et al, 1992, Jajri, 2007; Xu et al, 2010; Wei and Hao, 2011; Nowak-Lehhmann D. & Gross, 2015; Isreal, 2019).

According to Mankiw et al. (1992), human capital affects economic growth through three ways. It can accumulate as input factor, attracts physical capital investment and promotes total factor productivity growth.Openness influences total factor productivity through transferring technology and enhancing competitive advantage.Naz et al (2015) explored the impact of trade openness on the total factor productivity growth in a panel of 94 countries for the period of 1964 to 2003, and suggested that total factor productivity growth is positively affected by trade openness for all countries under study. Senbeta(2008) argued that technological spillover from FDI has positive effect on the total factor productivity of the host economy, but FDI inflow has negative short-term effectson total factor productivity. Development aid may reduce TFP and may discourage recipient countries' efforts. Nowak& Gross (2015) agreed this view, in which they found that development aid reduces TFP growth in the 0.1 and 0.25 quantiles.Morrissey (2001) suggested that there can be several positive channels through which foreign aid impacts economic growth:

"ODA increases investment in physical and human capital, aid increases the capacity to import capital goods or technology, aid does not have indirect effects that reduce investments or savings rates, and aid is associated with technology transfers that increase the productivity of capital and promotesendogenous technical change".

Based on these literatures, we can assert that TFP is determined by human capital, openness to the world economy, foreign direct investment and foreign aid. Therefore, this study augmentsequation (2) by imposing the following Cobb-Douglas production function.

$A_t = \psi MYS_t^{\gamma_1} LE_t^{\gamma_2} OP_t^{\gamma_3} FDI_t^{\gamma_4} AID_t^{\gamma_5}$ (3)

where ψ is constant, MYS, LE OP , FDI and AID are mean years of schooling, life expectancy, openness to the world economy, foreign direct investment and foreign aid, respectively. In this study, education(measured by MYS) and health (measured by LE) are used as indicators of human capital. By replacing A_t in equation (2) with equation (3), we arrive at the augmented form of growth model, which is specified as follows.

$Y_t = \psi K_t^{\alpha} L_t^{\beta} MYS_t^{\gamma_1} LE_t^{\gamma_2} OP_t^{\gamma_3} FDI_t^{\gamma_4} AID_t^{\gamma_5}$ (4)

We can linearize equation (4) by taking the natural logarithm of both sides as:

$$\ln Y_t = \ln\psi + \alpha\ln K_t + \beta\ln L_t + \gamma_1\ln MYS_t + \gamma_2\ln LE_t + \gamma_3\ln OP_t + \gamma_4\ln FDI_t + \gamma_5\ln AID_t + \varepsilon_t \quad (5)$$

Let lnψ be equal to θ,where θis a constant term, then equation (5) becomes:

$$\ln Y_t = \theta + \alpha\ln K_t + \beta\ln L_t + \gamma_1\ln MYS_t + \gamma_2\ln LE_t + \gamma_3\ln OP_t + \gamma_4\ln FDI_t + \gamma_5\ln AID_t + \varepsilon_t \quad (6)$$

wherelnis the natural logarithm operator and $\varepsilon_t$denotes the white-noise error term. There are various time series approaches that can be used to estimate equation (6). We select the appropriate approach based on unit root test and test of existence of long-run relationships amongst variables.

Data and descriptive statistics

This study used annual time series data covering from the period 1990 to 2018. We are interested to the period covered to reduce the complexity of analysis arising structural break. The data were obtained from World Bank database and from the National Bank of Ethiopia (NBE). We used GDP per capita (measured at constant local currency) to measure the economic performance (Y), gross capital formation to measure physical capital (K), labour (L), mean years of schooling (MYS) to measure education human capital, life expectancy (LE) to measure health human capital, sum of exports and imports (as percentage of GDP) to measure global openness (OP), foreign direct investment(FDI) net inflows and official development assistance (ODA) to measure foreign aid(AID).

Table 1: Descriptive statistics of variables

Statistics	lnY	lnK	lnL	lnMYS	lnLE	lnOP	lnFDI	lnAID
Mean	8.974	11.364	18.131	0.618	4.028	-1.057	18.814	3.182
Median	8.796	11.166	18.137	0.615	4.02	-0.969	19.42	3.217
Maximum	9.729	13.528	18.509	1.03	4.194	-0.672	22.145	3.81
Minimum	8.484	9.726	17.72	0.182	3.861	-2.1	9.019	2.255
Std. Dev.	0.399	1.026	0.237	0.278	0.114	0.346	2.929	0.494
Skewness	0.6	0.63	-0.077	-0.023	0.052	-1.573	-1.753	-0.5
Kurtosis	1.894	2.577	1.848	1.614	1.524	5.22	6.289	2.066
Jarque-Bera	3.109	2.063	1.577	2.245	2.554	17.288	26.962	2.184
Probability	0.211	0.357	0.455	0.325	0.279	0	0	0.336
Sum	251.259	318.181	507.657	17.308	112.789	-29.596	526.778	89.091
Sum Sq. Dev.	4.307	28.416	1.513	2.081	0.351	3.228	231.615	6.582
Observations	28	28	28	28	28	28	28	28

Moreover, we analyzed the time series property of the data (test of the unit root on each variable, optimal lag length, cointegration test using the ARDL bounds testing procedure and the results are discussed in detail as follows.

Econometric Results and Discussions

Results of unit root test

We start the empirical analysis by testing the stationarity properties of macroeconomic variables. The stationarity test is conducted todetect whether there is a spurious relation (high coefficient of determination with insignificant coefficients) among the variables. The econometric test of stationarity of macroeconomicvariables was carried by the Augmented Duckey-Fuller(ADF) test. In ADF test, we set the null and alternative hypotheses wherein theautomatic lag length selection uses Schwarz Info Criterion.
Null hypothesis: the series has unit root
Alternative hypothesis: the series is stationary.

Table 2:Augmented Dickey-Fuller (ADF) unit root tests at level and first difference

Type of test for unit root	Variables	Test equation	ADF unit root test						Order of integration
			ADF statistic	Lag length	Critical Value				
					1%	5 %	10%	p-value	
At level	lnY	With C	1.903	0	-3.700	-2.976	-2.627	0.9997	I(1)
		With C & T	-2.116	0	-4.339	-3.588	-3.229	0.5143	
		Without C	4.148	1	-2.657	-1.954	-1.609	0.9999	
	lnK	With C	2.405	4	-3.753	-2.998	-2.639	0.9999	I(1)
		With C & T	-0.946	0	-4.339	-3.588	-3.229	0.9353	
		Without C	4.102	0	-2.653	-1.954	-1.610	0.9999	
	lnL	With C	0.282	3	-3.738	-2.992	-2.636	0.9722	I(0)
		With C & T	-3.790	2	-4.374	-3.603	-3.238	0.0344*	
		Without C	3.456	3	-2.665	-1.956	-1.609	0.9996	
	lnMYS	With C	-0.535	0	-3.700	-2.976	-2.627	0.8692	I(0)
		With C & T	-3.674	5	-4.441	-3.633	-3.255	0.0463**	
		Without C	4.066	0	-2.653	-1.954	-1.610	0.9999	
	lnLE	With C	1.257	6	-3.788	-3.012	-2.646	0.9974	I(0)
		With C & T	-5.537	5	-4.441	-3.633	-3.255	0.0010***	
		Without C	5.396	6	-2.680	-1.958	-1.608	1.0000	
	lnOP	With C	-5.414	1	-3.711	-2.981	-2.630	0.0002***	I(0)
		With C & T	-1.126	0	-4.339	-3.588	-3.229	0.9055	

		Without C	-2.069	1	-2.657	-1.954	-1.609	0.0391**	
	lnFDI	With C	-5.182	0	-3.700	-2.976	-2.627	0.0003***	I(0)
		With C & T	-5.097	0	-4.339	-3.588	-3.229	0.0017***	
		Without C	1.584	0	-2.653	-1.954	-1.610	0.9689	
	lnAID	With C	-0.385	0	-3.700	-2.976	-2.627	0.8983	I(1)
		With C & T	-1.949	0	-4.339	-3.588	-3.229	0.6019	
		Without C	0.758	0	-2.653	-1.954	-1.610	0.8718	
At first differences	DlnY	With C	-5.677	0	-3.711	-2.981	-2.630	0.0001***	All first differences are I(0)
		With C & T	-6.171	0	-4.356	-3.595	-3.233	0.0002***	
		Without C	-3.193	0	-2.657	-1.954	-1.609	0.0026***	
	DlnK	With C	-6.510	0	-3.711	-2.981	-2.630	0.0000***	
		With C & T	-3.488	2	-4.394	-3.612	-3.243	0.0635*	
		Without C	-0.247	4	-2.674	-1.957	-1.608	0.5857	
	DlnL	With C	-3.518	2	-3.738	-2.992	-2.636	0.0164**	
		With C & T	-1.497	2	-4.394	-3.612	-3.243	0.8020	
		Without C	-0.406	3	-2.669	-1.956	-1.608	0.5259	
	DlnMYS	With C	-7.837	0	-3.711	-2.981	-2.630	0.0000***	
		With C & T	-7.733	0	-4.356	-3.595	-3.233	0.0000***	
		Without C	-0.893	3	-2.669	-1.956	-1.608	0.3184	
	DlnLE	With C	-5.137	5	-3.788	-3.012	-2.646	0.0005***	
		With C & T	-4.875	5	-4.468	-3.645	-3.261	0.0044***	

		Without C	0.314	6	-2.686	-1.959	-1.607	0.7664	
	DlnOP	With C	-4.062	0	-3.711	-2.981	-2.630	0.0044***	
		With C & T	-6.735	0	-4.356	-3.595	-3.233	0.0000***	
		Without C	-3.973	0	-2.657	-1.954	-1.609	0.0003***	
	DlnFDI	With C	-4.895	1	-3.724	-2.986	-2.633	0.0006***	
		With C & T	-4.882	1	-4.374	-3.603	-3.238	0.0033***	
		Without C	-4.211	0	-2.657	-1.954	-1.609	0.0002***	
	DlnAID	With C	-3.838	0	-3.711	-2.981	-2.630	0.0074***	
		With C & T	-3.946	0	-4.356	-3.595	-3.233	0.0243**	
		Without C	-3.831	0	-2.657	-1.954	-1.609	0.0005***	

*, ** and ***indicates the rejection of the null hypothesis (unit root) at 10%, 5% and 1% level of significance respectively where, C and T are constant and T trend, respectively.

From Table 2 we observe that exceptlnY, lnK and lnAID, which are stationary at first difference, the rest variables (lnL, lnMYS, lnLE, lnOP and lnFDI) are stationary at level. When variables in a given model are mixed, i.e., some variables are stationary at level and others are stationary at first difference, Autoregressive Distributed Lag(ARDL) model is the appropriate time series approach to estimate the coefficients.Furthermore, there are threereasons why the ARDL approach is appropriate in this study. First,ARDL allows us to explore both the short- and long-run relationships between growth andits determinants. Second, ARDL, unlike other approaches, does not impose the restrictiveassumption that all the variables under study must be integrated of the same order. It is applicableto variables that are integrated of order zero and one, or a mixture of both. Third, this approach isrobust in small samples (Pesaran et al., 2001).Hence, since the sample in this study is small (28 observations in this study), the ARDL approach is the appropriate approach forthe empirical analysis.

ARDL bounds testing procedure for cointegration

Havingestablished that the variables are integrated of order one at the most, we can then proceed to testthe long-run relationships between GDP per capita and its determinants using the ARDL boundstesting procedure. However, before we conduct ARDL bounds testing procedure for cointegration**,** we need to select the optimallag length. There are many tests that can be used to choose optimal lag length. These are the log likelihood (LL), Akaike information criteria (AIC), Schwarz information criteria (SC) and Hannan-Quinn information criteria (HQ).

Table3: VAR lag order selection criteria, Sample: 1991-2018; Number of observation = 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	199.0282	NA	9.88e-17	-14.15024	-13.76629	-14.03607
1	547.5566	464.7045*	8.58e-26*	-35.22642*	-31.77085*	-34.19889*

Endogenous variables: LPCGDP LGCF LTP LMYS LLE LOP LFDI LAID, Exogenousvariables: C,* indicates lag order selected by the criterion

Table 3 indicates thatthe optimal lag length to carry out the ARDL bounds testing procedure for cointegration is one. Therefore, we include lag value of order one in the specification of equation(6)in order to test cointegration using the ARDL bounds testing procedure, which takes the following form:

$$\Delta lnY_t = \eta_0 + \eta_1 \Delta lnY_{t-1} + \eta_2 \Delta lnK_{t-1} + \eta_3 \Delta lnL_{t-1} + \eta_4 \Delta lnMYS_{t-1} + \eta_5 \Delta lnLE_{t-1} + \eta_6 \Delta lnOP_{t-1} + \eta_7 \Delta lnFDI_{t-1} + \eta_8 \Delta lnAID_{t-1} + \rho_1 lnY_{t-1} + \rho_2 lnK_{t-1} + \rho_3 lnL_{t-1} + \rho_4 \text{ln}MYS_{t-1} + \rho_5 lnLE_{t-1} + \rho_6 lnOP_{t-1} + \rho_7 lnFDI_{t-1} + \rho_8 lnAID_{t-1} + \varepsilon_t \quad (7)$$

where ε, η and ρ are the white-noise error term, the short-run coefficients and the long-runcoefficients of the model, respectively, and Δ is the first difference operator.

The null hypothesis of no cointegration among variables is specified of the form:

H_0: $\rho_1 = \rho_2 = \rho_3 = \rho_4 = \rho_5 = \rho_6 = \rho_7 = \rho_8 = 0$

This is tested against the alternative hypothesis of cointegraion among variables of the form:

H_1: $\rho_1 \neq \rho_2 \neq \rho_3 \neq \rho_4 \neq \rho_5 \neq \rho_6 \neq \rho_7 \neq \rho_8 \neq 0$

The variables are said to be cointegrated if we can reject the null hypothesis. To make a decision, we compare the calculated F-statistic with a set of critical values compiled by Pesaran et al. (2001) under this null hypothesis. If the F-statistic becomes below the lower bound values, then we fail to reject this null hypothesis and we conclude that there is no cointegration among variables. In contrast, if the F-statistic becomes greater than the upper-bound values, we reject the null hypothesis and we conclude that there is cointegration among variables. The F-statistic may also lie between the lower and upper bound values. In this case, the test is inconclusive (Pesaran et al., 2001). When it comes down to the data, we first estimated equation (7), which must be followed by serial correlation and stability tests. If there is no serial correlation and the model is stable, we proceed to ARDL bounds testing procedure for cointegration. As reported in Table 2 of appendix part, Breusch-Godfrey serial correlation LM indicates no serial correlation problem since the p-value(0.4107) is greater than 0.05. Moreover, the CUSUM test of model stabilityshows that the model is free of instability problem, which enables us to carryout ARDL bounds testing procedure for cointegration.

Table 4: ARDL bound test

F-test statistic	Critical values, k = 7						Co-integration status
	Level of significance						
	1%		5%		10%		
3.205*	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
	2.96	4.26	2.32	3.50	2.03	3.13	Co-integrated at 10%

* denote significance at 10%. Critical values are based on Pesaran et al (2001), I (0) and I (1) represent lower bound and upper bound of critical values, respectively.

Comparing the F-statistic against the critical values at 1%, 5% and 10% indicates that F-statistic (3.205) is greater than the upper bound value (3.13) at 10% significance level, implying that we have to reject the null hypothesis. Therefore, we decide that the variables are cointegrated even though the evidence is weak since the null hypothesis is rejected at 10%. Having confirmed that the variables are cointegrated, we can estimate both long-run and short-run model, which are specified as follows. The short-run relationship model takes of the form:

$$\Delta \ln Y_t = \eta_0 + \eta_1 \Delta \ln Y_{t-1} + \eta_2 \Delta \ln K_{t-1} + \eta_3 \Delta \ln L_{t-1} + \eta_4 \Delta \ln MYS_{t-1} + \eta_5 \Delta \ln LE_{t-1} + \eta_6 \Delta \ln OP_{t-1} + \eta_7 \Delta \ln FDI_{t-1} + \eta_8 \Delta \ln AID_{t-1} + \delta ECT_{t-1} + \varepsilon_t \quad (8)$$

where δ is the coefficient of the error correction term , ECT_{t-1}, and is expected to have a negative sign. The long-run relationship model takes of the form:

$$\ln Y_t = \theta + \alpha \ln K_t + \beta \ln L_t + \gamma_1 \ln MYS_t + \gamma_2 \ln LE_t + \gamma_3 \ln OP_t + \gamma_4 \ln FDI_t + \gamma_5 \ln AID_t + \varepsilon_t \quad (9)$$

Long-run analysis

Table 5: Long-run model estimation result

Dependent variable: lnY	
Explanatory variables	Coefficients
lnK	0.264***(0.036)
lnL	-1.972***(0.442)
lnMYS	-0.020(0.365)
lnLE	5.915***(0.896)
lnOP	-0.127**(0.050)
lnFDI	-0.005(0.008)
lnAID	-0.107***(0.037)
Constant	18.227(6.155)
R-squared	0.995
Log likelihood	60.619
F-statistic	567.188
Prob(F-statistic)	0.000
Durbin-Watson stat	1.867

Note: Values in the parentheses are standard errors. *, ** and *** represent significance at 10%, 5% and 1%, respectively.

To check the adequacy of the estimated long-run, residual and stability diagnostic tests are undertaken. The results indicate that there is no serial correlation and heteroskedasticity, and the errors are normally distributed. The Ramsey functional form test also confirms that the long-run model is adequate. In addition to above diagnostic tests, the stability of long-run estimates is checked by CUSUM test, and the test confirms that the long-run model is stable. Hence, the estimates of the estimated long-run model are reliable and efficient. The residual diagnostic and stability tests are reported in Table 3 and figure 4 of appendix, respectively.

In the long-run, GDP per capita of Ethiopia is significantly affected bygross capital formation(proxy for physical capital), labour force, life expectancy, openness to the world economy and foreign aid. While gross capital formation and health human capital affect GDP per capita positively in the long-run, labour force, openness and foreign aid impact GDP per capita negatively. Education human capital and FDI are found to be insignificant in affecting GDP per capita in long-run.

Regarding the effect of gross capital formation, the result shows that, in the long-run, a percentage increase in the gross capital formation leads to a 0.26% increase in GDP per capita, keeping other factors unchanged. Such a positive impact supports the fact that that increasing investment size enhances productivity which has a spillover effects on economic performance. In development process physical capital accumulation can be a primary engine for economic growth. This result is consistent with study by Bond et al. (2004), in whichtheyfound that the share of physical capital investment in GDP has a large and significant effect on the long-run economic growth rate.

In contrary to gross capital formation, a percentage increase in labour force results in 1.97% decrease in GDP per capita in the long-run, other factors remain unchanged. This may be due to the combined effect of lower capacity of the economy to absorb the increasing labour force and low productivity of the labour force in the country. This negative relationship between labour and GDP per capita is also explained by Todaro and Smith (2012). As it is obvious, Todaro and Smith (2012) stressed that an increase in labour, which is mainly caused by rapid population growth, lowers per capita income growth in most developing countries, especially those that are already poor,dependent on agriculture, and experiencing pressures on land and natural resources. A similar finding is clearly documented in the work of Sin-Yu and Bernard (2018), in which they found a percentage increase in labour leads to a 0.85 % decrease in real GDP per capita.

The other important factor that can affect economic growth in the long-run is health human capital, which is measured by life expectancyat birth in this study. This study shows that, in the long-run, a percentage increase in life expectancy leads to 5.92% increase in GDP per capita.Cervellati and Sunde (2009) developed a theory that predicts the relationship between life expectancy and income per capita, which may be positive or negative. According to the theory, the effect of life expectancy on income per capita is not the same during different phases of economic and demographic development. The theory predicts that increase in life expectancy mainly increases population growthbefore the onset of the demographic transition, which tends to reduce per capita income. The effect is opposite after the transition, when life expectancy leads to an increase of income per-capita. Cervellati and Sunde (2009)examinedthe theory empirically, and found that increases in life expectancy increases population growth, affects human capital little and therefore tend to reduce income per capita in pre-transitional countries. However, life expectancy leads to lower population growth, greater human capital and strongly increases income per capita in post-transitional countries. In contrary to the health human capital, the effect of education human capital on GDP per capita is found to be insubstantial, which contradicts result obtained by Gidey (2015). The inconsequentiality of education human capital may be due to the worsening of education quality occurring in Ethiopian education system though the country has achieved enormous success in accessing education. There is strong evidence that quality of education, rather than mere school attainment is powerfully related to economic growth (Hanushek&Wößmann, 2007).

Moreover, this study found that trade openness has a negative effect on the long-run economic growth in Ethiopia. As we observe from Table 5, a percentage increase in trade openness yields about 0.13% decrease in GDP per capita, ceteris paribus. This result contradicts with the findings of Ahmed and Kenji (2016) and Keyo (2017); who found that trade openness has positive effects on economic growth in the long run.Ethiopia is characterized by low financial development, high-inflation, low-income and agricultural country. Openness to trade has negative effect on economic growth in countries with these attributes (Kim et al, 2012; Keyo, 2017).

Foreign aid also negatively affects the economic performance of Ethiopia in the long-run. As shown in Table 5, a percentage increase in foreign aid leads to about 0.11% decrease in GDP per capita, when other things remain constant. The negative effect of aid on economic growth happens due to the fact that foreign aid may not be used for the intended purpose and is oftencorrupted by the government officials. Burnside and Dollar (2000) showed shat foreign aid does not work in distorted policy environments, such as high-inflation rate, high budget deficit and high government consumption in GDP. These all characterize Ethiopian economy and therefore, the negative effect of foreign aid on economic growth soundsin Ethiopia.

We also estimate the short-run coefficients though the concern of this study is to investigate determinants of economic growth in the long-run. As it is shown in Table 6, all the short-run estimates are found to be statistically insignificant. This indicates the explanatory variables explain the long-run economic growth than the short-term fluctuationsoccurring in the economy. However, the short-run model estimation gives interesting result on the coefficient of the error correction term. The estimated error correction term (−0.99) is significant, has the correct sign, and imply a very high speed of adjustment to equilibrium after a shock happened. Approximately about percent 99 % of the short run deviation from the long run equilibrium is adjusted annually.The significance of error correction term reveals that there is a stable long-run relationship among variables.

Table6: Short-run model estimation result

Dependent variable: ΔlnY	
Explanatory variables	Coefficients
ΔlnY(-1)	0.613*(0.342)
ΔlnK(-1)	-0.068(0.101)
ΔlnL(-1)	2.429(5.901)
ΔlnMYS(-1)	-0.332(0.329)
ΔlnLE(-1)	1.541(3.338)
ΔlnOP(-1)	-0.068(0.095)
ΔlnFDI(-1)	-0.002(0.011)
ΔlnAID(-1)	0.025(0.074)
ECT(-1)	-0.999**(0.457)
Constant	-0.050(0.186)
R-squared	0.516
Log likelihood	50.730

F-statistic	2.016
Prob(F-statistic)	0.102
Durbin-Watson stat	2.087

Note: Values in the parentheses are standard errors. *, ** and *** represent significance at 10%, 5% and 1%, respectively.

Conclusion and Policy Implications

The annual growth in GDP per capita has shown large up and downward movements, especially during the first two decades of EPRDF regime even if the regime followed the same economic policy during its ruling periods. The objective of this study is to investigate macroeconomic determinants of long-run economic growth over 1991-2018 periodsTo find out the determinants, the study used the ARDL approach to cointegration. The result shows that there is long-run co-integration among the variables under study. The main finding of the study is that in the long-run, gross capital formation, labour force, health human capital (proxied by life expectancy), openness to the world economy and foreign aid significantly impact growth in GDP per capita in Ethiopia. Physical capital and health human capital positively contribute to GDP per capita.The finding of this paper is consistent with the Solow growth model (since accumulation of physical capital leads to increase in GDP per capita). The positive impact of increase in health human capital on economic growthoccurs throughimproving knowledge and technology. This also suggests that this finding is consistent with the endogenous growth model. On the other hand, labour, openness to the world economy and foreign aid affect the long-run economic growth of Ethiopia negatively. The negative relationship is explained by bad policy environment, such as low financial development, high-inflation, higher budget deficit as well as high reliance of the Ethiopian economy on agriculture.

The results of this study have important policy implications. First, increasing domestic savings, which leads to increase in investment and accumulation of physical capital, should be taken priority attention in economic growth plans. Moreover, public expenditures need to be allocated toward providing better health services and improving education quality, which can augment the positive spillover effects of human capital in the long-run. Finally, the government needs to work better toward reducing high reliance on foreign aid through increasing internal budget deficit financing mechanisms as well as promoting financial markets development in order to improve the long-run economic growth in country.

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Appendix

Table 1: Regression result of ARDL bounds testing procedure for cointegration

Dependent variable: D(lnY)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔlnY(-1)	0.546	0.336	1.625	0.1353
ΔlnK(-1)	-0.043	0.088	-0.487	0.6369
ΔlnL(-1)	26.999	31.198	0.865	0.4071
ΔlnMYS(-1)	-0.034	0.485	-0.070	0.9455
ΔlnLE(-1)	-4.010	13.552	-0.296	0.7734
ΔlnOP(-1)	-0.181	0.116	-1.560	0.1499
ΔlnFDI(-1)	-0.011	0.013	-0.866	0.4069
ΔlnAID(-1)	-0.075	0.103	-0.723	0.4860
lnY(-1)	-0.995	0.427	-2.331	0.0420
lnK(-1)	0.083	0.120	0.694	0.5038

lnL(-1)	-0.673	1.484	-0.454	0.6596
lnMYS(-1)	0.170	0.858	0.198	0.8469
lnLE(-1)	4.187	3.706	1.130	0.2850
lnOP(-1)	-0.158	0.112	-1.407	0.1898
lnFDI(-1)	0.015	0.015	1.002	0.3401
LAID(-1)	-0.033	0.152	-0.219	0.8313
Constant	2.167	16.734	0.130	0.8995
R-squared	0.826	Mean dependent variable		0.041394
Adjusted R-squared	0.548	S.D. dependent variable		0.054156
S.E. of regression	0.036	Akaike info criterion		-3.521475
Sum squared resid.	0.013	Schwarz criterion		-2.705578
Log likelihood	64.540	Hannan-Quinn criteria.		-3.278866
F-statistic	2.968	Durbin-Watson stat		2.177960
Prob(F-statistic)	0.043			

Table 2: Breusch-Godfrey Serial correlation test result of equation 7

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.231392	Prob. F(1,9)	0.6420
Obs*R-squared	0.676776	Prob. Chi-Square(1)	0.4107

Table 3: Diagonistic tests of the long-run model

Breusch-Godfrey Serial Correlation LM Test of long-run model			
F-statistic	0.043	Prob. F(1,19)	0.8378
Obs*R-squared	0.063338	Prob. Chi-Square(1)	0.8013
Heteroskedasticity Test: Breusch-Pagan-Godfrey test of long-run			
F-statistic	0.591732	Prob. F(7,20)	0.7551
Obs*R-squared	4.804029	Prob. Chi-Square(7)	0.6839
RAMSEY RESET Test			
	Value	df	Probability
t-statistic	1.290742	19	0.2123
F-statistic	1.666014	(1, 19)	0.2123
Likelihood ratio	2.353444	1	0.1250

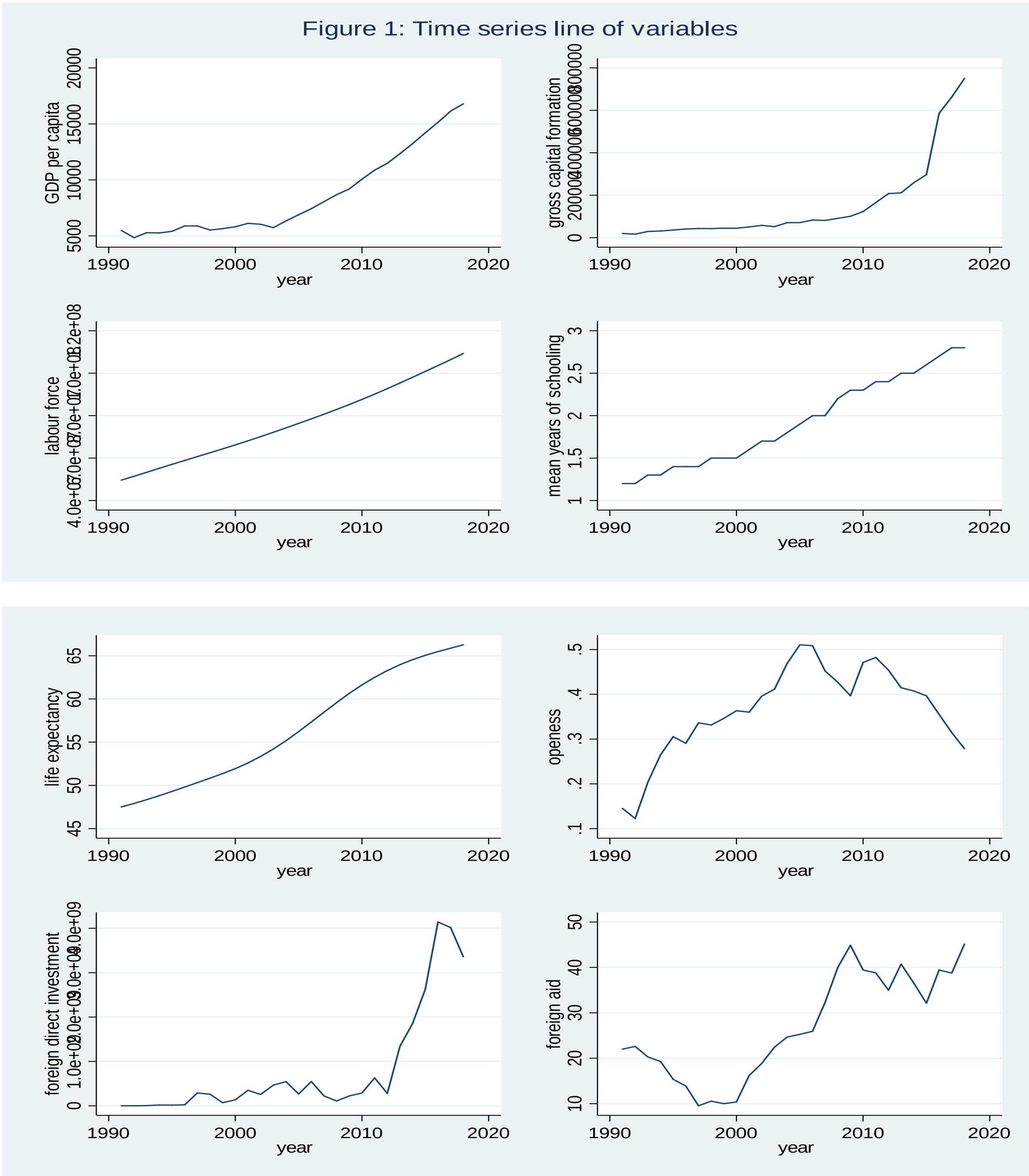

Figure 1: Time series line of variables

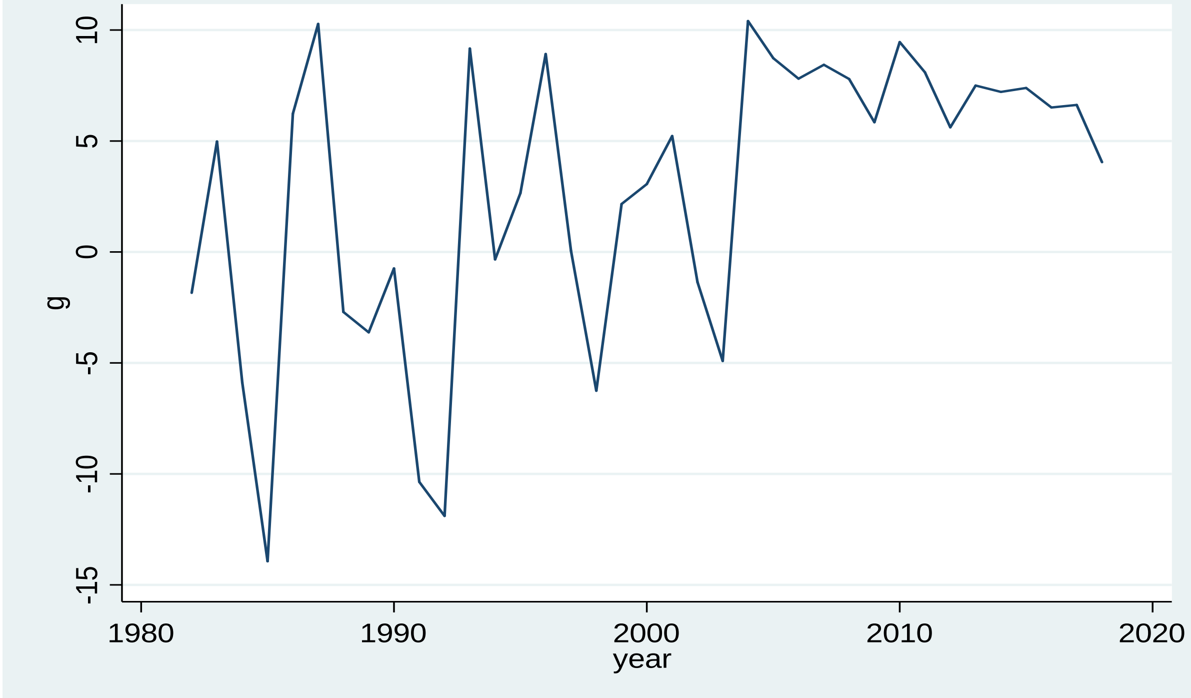

Figure 2: Annual GDP per capita growth of Ethiopia: 1982-2018

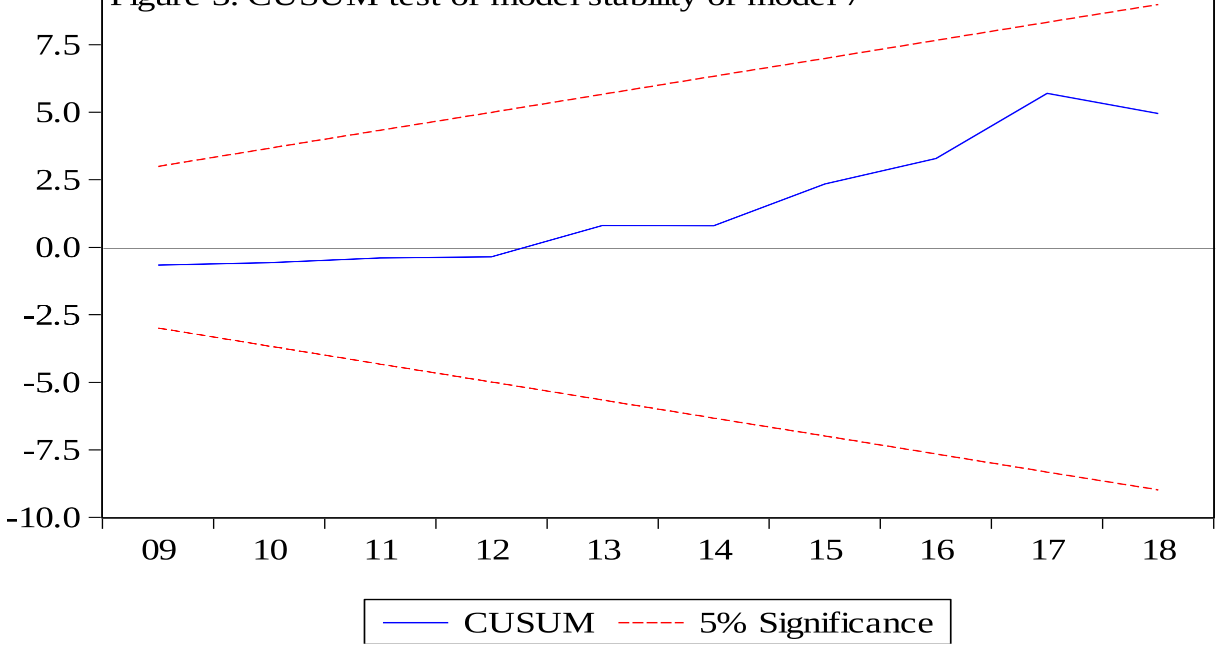

Figure 3: CUSUM test of model stability of model 7

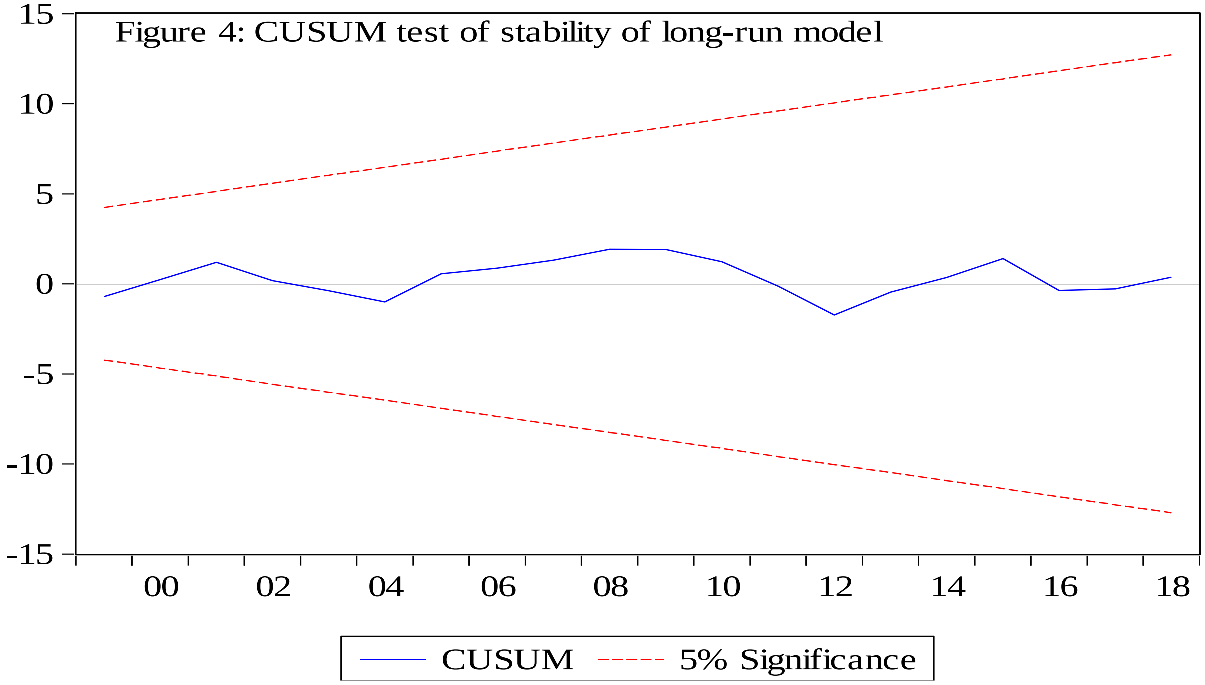
Figure 4: CUSUM test of stability of long-run model
15
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CUSUM
5% Significance