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Research Report

An empirical analysis of the Determinants of Real GDP Growth in Sierra Leone from 1980-2018

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An empirical analysis of the Determinants of RGDP Growth in Sierra Leone from 1980-2018

Abstract

The purpose of the research was the exploration of macroeconomic determinants of economic growth in Sierra Leone for the period, 1980- 2018, and whether there exist an association between the determinants and economic growth is long-term and short-term. The research methodology was quantitative and it was limited to eight mostly macro-fiscal variables and the empirical model employed was the Autoregressive Distributed Lag model. The findings revealed foreign direct investment was positive in both the short and long run but only statistically significant at the 10% level in the short-run dynamic model. Gross capital formation and population growth were also positive and statistically significant in determining RGDP growth in both the static long-run and dynamic short-run models. Openness to trade has a negative and significant impact on RGDP growth in the short run but insignificant in the long run. On the other hand, real exchange fluctuations, domestic credit rate, private remittances are negative and statistically significant towards RGDP growth. The dummy variable war is significant in both long and short-run but exerted no negative impact on RGDP. The other dummy variable Ebola had the expected negative sign both in the long run and short-run but it is also statistically insignificant. Also, applying the Bounds test Cointegration model, the findings revealed a statistically significant long-run association between economic growth and the specified determinants (F-statistics value= 15.18749, and an upper bound value or I(1) value = 2.08). Furthermore, the error correction model applied to determine the short-run deviation from the long-run had the expected sign, and was statistically insignificant (ECM = -0.131559), *indicating convergence towards equilibrium occurred at the rate of 13% in the period under review. However, the research was limited to* predominantly macro-fiscal variables, future research must also look at the impact of monetary variables.

Keywords: *Growth determinants, Sierra Leone, ARDL approach, applied econometrics, macro-fiscal variables*

- ## Introduction

Understanding the factors which cause economic expansion and contraction is the central preoccupation of empirical and theoretical macroeconomists and researchers. There have been essentially two strands of views posited by economists and growth researchers. The first is the neoclassical growth theory and endogenous growth theories. At the core of their analysis is the

importance of state factors such as the accumulation of physical capital and human capital development (Solow 1956; Romer 1986; Lucas 1988). An important extension of the neoclassical growth model was the inclusion of human capital stock as one of the key factors driving economic growth to complement physical capital accumulation (Mankiw, Romer, and Weil 1992; Islam 1995).

The other strand is the exogenous growth models, these also advocates for the accumulation of physical capital as an important driver of economic growth in the short run, while technological advancement is the key determinant of economic growth in the long run.

Much as there is consensus that state factors such as the accumulation of physical capital (investment) and human capital stock, on the one hand, and productivity factors (technological growth) on the other, are important macroeconomic determinants of economic growth in almost any country, there are other proponents who postulate that factors affecting the efficiency of savings and investment are equally important determinants in influencing economic growth (Easterly and Wetzel 1989; World Bank 1990; Fischer 1992). These efficiency factors became prominent in the 1990s, with three key outcomes being targeted: stability of the macro-economic environment; effectiveness of the institutional framework of an economy-related to political and economic governance, incentive structures and social infrastructure; and the setting up of the right price mechanism and necessary regulatory environment to clear markets (World Bank 1990; Snowdon and Vane 2005).

Whist the analytical framework to determine the common determinants of macroeconomic growth are largely known, however, many governments do not fully know the key drivers of economic growth specific to their economies. As such the new literature on empirical growth, research stresses the importance of how country-specific development plans and economic reforms can cause different equilibria, or time paths, for per capita income growth (Azariadis and Drazen 1990; Durlauf and Johnson 1995).

This paper, therefore, aims to empirically test the factors that determine economic growth in Sierra Leone over a long historical period. The paper differs fundamentally from similar studies about Sierra Leone as it focuses on the key macroeconomic determinants of economic growth adding remittances from abroad, and factoring the impact of instability factors such as the war and the Ebola epidemic.

- **Socio-Political and Macroeconomic Context in Sierra Leone**

Since the end of it Civil war in 2002, Sierra Leone has enjoyed relative peace and modest economic growth. It has consolidated its peace and held multiple elections and peaceful transfers of power. The current SLPP ruling government has instituted some reforms on economic governance such as; the treasury single account and the free education program which is intended to improve macroeconomic performance and the country's human capital development. Even though Sierra Leone is seeking to attain middle-income status by 2035, it, however, still carries its post-conflict attributes of high youth unemployment, corruption and weak governance. The country continues to face the daunting challenge of enhancing transparency in managing its natural resources and creating fiscal space for development. Problems of poor infrastructure and widespread rural and urban impoverishment persist despite remarkable strides and reforms. Agriculture CONTINUES to drive the non-iron ore gross domestic product (GDP) growth, and the sector, spurred by increased investments and expansion in the crops, livestock and fisheries sub-sectors. Macro fiscal management challenges remain as inflationary pressure and exchange rate depreciation persists. Besides, the fiscal deficit and low revenue mobilization are still systemic problems.

REVIEW OF LITERATURE

Theoretical Literature review

Practical analysis of the Solow-Swan model of economic growth appears to hypothesize an uninterrupted production utility connecting productivity to the inputs of capital and labour, which induces steady-state stability of the economy. However, the steady-state growth relied on technology advancement and population growth, which were both exogenous in the model and the nonexistence of technological advancement, the growth of steady-state per capita productivity was nonrealistic (Ghura & Hadjimichael, 1996). Also, Ghura and Hadjimichael (1996) surmised a significant assumption in the neoclassical growth was that output stages of nations with comparable technologies ought to converge to an agreed stage in a steady-state, but current research studies equally exposed the unrestricted convergence assumption was irregular with the empirical revelation.

Because of the inadequacy of the neoclassical theory, which relied on the exogenous technological progress, Romer (1986) developed the endogenous economic growth theory, in the effort to

generate a long-run connection between growth and public policies. The endogenous growth model underscored technical development as the consequence of the degree of speculation, the scope of the capital accumulation, and the accumulation of human resources. There are several other postulated economic growth models after Romer's (1986) endogenous model, including the resource curse hypothesis, but there is barely any comprehensive agreement among the distinct growth models regarding the true determinants of economic growth in a country. This is because no two countries have the same characteristics, and a feature that may be effective in determining the economic growth of a country may be insignificant in the economic growth determinant of another country. Thus, there are several elements, including foreign direct investment (FDI), gross capital formation, remittances, domestic credit rate, and exchange rate, among others (Adeleke, Olowe, & Fasesin, 2014; Andraz & Rodrigues, 2010; Eregha, 2015), featured in the current journals in determining the economic growth of a nation.

Lo et al. (2013), for example, acknowledged the part of FDI as a significant determinant of economic growth. The authors argued that FDI was a derivative of the neoclassical growth theoretical model and, thus, it was theoretically conceivable that FDI can enhance growth through the transportation of outward investment, cutting-edge technology, and improved administration in organizations in the host nation. Owing to its possible spillovers, FDI ought to wield compelling positive influence on growth, including augmenting the economic environment of the host nation.

In his research on trade openness, FDI, and growth in Sub-Saharan African countries, Babatunde (2011), for instance, realized FDI was positive and statistically significant in enhancing economic growth in the selected nations.

Equally, the gross capital formation has also become a noteworthy macroeconomic element applied in determining the economic growth of a country and is ubiquitous in the current literature (Adeleke, 2014; Akram, Manzoor, Hassan, Farhan, & Alam, 2011). Eregha (2015) accentuated the importance of gross capital formation as a determinant of economic growth in his research on FDI inflow, volatility, and domestic investment in West Africa.

Concerning the exchange rate as a supplementary determinant of economic growth of a country, Alemu and Lee (2015) had argued that, in theory, the devaluation of the national currency exchange rate against the US dollar ought to epitomize the prospect of advancing exports. Alemu and Lee surmised that devaluation and an exchange rate stability had a positive relationship with economic growth. The exchange rate has also been a noteworthy macroeconomic element in

some empirical studies on the determinants of economic growth of a country (Adeleke, 2014) Kogid et al. (2012), for example, had maintained that international exchange rates were an essential gauge of the inclusive condition of the economy.

Trade openness has been posited to have positive and impacts on economic growth. Nowbutsing (2014), for example, argued that even when free trade advanced to several gains, nations were hardly equipped to permit a comprehensive free trade. This is because many nations espoused protectionism procedures like tariffs barriers and non-tariff barriers for dissimilar motives, which may obstruct economic growth. Yusoff and Nuh (2015) had similarly researched FDI, trade openness, and economic growth in Thailand and recognized that trade openness, among others, had a long-run association with economic growth. Supplementary research findings have, however, recognized negative or positive but weak associations between trade openness and economic growth (Bibi, Ahmad, & Rashid, 2014; Eris & Ulasan, 2013). Eris and Ulasan (2013) even acknowledged the realization that, contrary to previous cross-state growth research studies, his findings did not support the principle that trade openness had a strong and direct association with economic growth in the long-term.

Applying a log-log regression model on the time series data for the period, 1990 to 2014, Guga et al. (2015) found that the total population growth rate, among others, had a positive and significant effect on the economic growth of Albania. Ali et al. (2013) also realized population growth had a long-run positive effect on economic growth, in their research on population growth and economic development in Pakistan, even though the short-term effect of population growth on economic growth was negative. Alternatively, other academics have realized a negative association between population growth and the economic growth of a country (Dao, 2012; Wako, 2012). Dao (2012), for example, realized a negative association between population growth (human capital) and economic growth, in his research on population and economic growth in developing nations. Concluding, the significance of population as a proxy of human capital in determining the economic development of a country likewise appears mixed in this review.

Massive inward remittance flows can lead to a real exchange rate appreciation, known as the Dutch Disease effect. Despite the positive contribution of remittances to poverty and household welfare, most studies have found that remittances have a negative effect on exchange rate appreciation and export competitiveness. In theory, the actual effect that international remittances have on the real exchange rate depends on various factors. On the one hand, the

pressure of remittances on the real exchange rate can increase if remittance-receiving households tend to substitute leisure for goods, that is, they use their remittances to consume more leisure and work less. Reduced labour supply by households implies rising wages, and rising wages tend to intensify the effects of remittances on the real exchange rate.

Empirical Literature Review

Most and Vann de Berg (1996) investigated the determinants of economic growth in eleven Sub-Saharan Africa countries using country-specific time series growth models. The study results revealed mixed results. Foreign aid was found to be negatively and significantly associated with economic growth in Togo, Ivory Coast, Nigeria, Zambia, Rwanda, and Botswana: on the other hand, it was positively and significantly associated with economic growth in Niger, Senegal and Mauritius.

Hamilton and Monteagudo (1998), using least squares regression, re-examined the Mankiw, Romer, and Weil (1992) empirical model, using data covering the period 1960-1985. The variables included were changes in the rate of physical investment, the average percentage of the working-age population that was in secondary school, and the average annual rate of growth of the working-age population for that country between 1960 and 1970. They found that changes in output growth were positively and significantly associated with changes in the rate of physical investment. However, changes in human capital development were negatively and significantly associated with economic growth. They also found that the coefficient on the change in population growth was not statistically significant (Hamilton and Monteagudo, 1998, p. 500).

Chang and Mendy (2012) investigated the empirical relationship between openness and economic growth in 36 African countries during the period 1980-2009. Using a panel fixed effects regression model, the study results revealed that foreign aid, exports, imports, labour employed and trade openness were positively and significantly associated with economic growth: however, foreign direct investment, domestic investment, and gross national savings were negatively and significantly associated with economic growth. The study also found that foreign aid exhibited mixed results when disaggregated by region. In the Middle and North Africa regions, foreign aid was positively and significantly associated with economic growth; while in the West and East Africa regions foreign aid was negatively and significantly associated with economic growth.

Nsiah et al. (2016), alternatively found the effect of FDI on Sub-Saharan African economies as positive, but statistically insignificant. The reason for this, among others, was the recognition that, FDI inflows into Sub-Saharan Africa were largely focused on the mining and export of raw materials, progressing to negligible benefit to the national economy (Nsiah et al., 2016). Likewise, Leshoro (2014) realized a complete negative association between FDI and GDP in his vector autoregression model approach, to explore the impacts of foreign capitals inflow and savings on the economic growth of South Africa. Therefore, notwithstanding the comprehension of a rising sign of the influence of FDI on the economic growth of host nations, the review also showed no decisive agreement to this statement. This is because; supplementary studies have unveiled negative or no association between FDI and economic growth in some host nations.

Applying the panel data model on the Economic Commission of West African States (ECOWAS), Eregha realized the real growth rate significantly and positively influenced the increase of domestic investment (gross capital formation) in the ECOWAS region. Correspondingly, Adekele (2014) also affirmed the significance of gross capital formation as a determinant of economic growth, in his research on FDI-growth nexus in Africa. Applying the panel data model on 31 Sub-Saharan African countries, Adekele found that gross capital formation was significantly and positively associated with economic growth in all the three statistical techniques employed in the panel data model. Similarly, Javed et al. (2014), in their research on the volatility effect of macroeconomic variables on economic growth, correspondingly found that gross capital formation had a positive association with GDP, with a statistically significant coefficient value of .084115.

Applying the autoregressive distributed lag model in their research on the effects of the exchange rates on Malaysia's economic growth, Kogid et al. found the nominal and real exchange rates had positive long-run impacts on growth, even when the nominal exchange rate impact was insignificant. Meanwhile, Adeleke (2014) recognized in his research on FDI-growth nexus in Africa that, the exchange rate was negatively associated with economic growth, and this was especially significant since currency devaluation inclined to stimulate growth. Adeleke's (2014) findings were consistent with Alemu and Lee's (2015) argument that devaluation of the national currency exchange rate against the US dollar encouraged the possibility of improved exports. Javed et al. (2014) equally realized exchange rate had a negative effect on economic growth, in their research on the effect of macroeconomic elements on the economic growth of Pakistan,

though this effect was insignificant. Thus, the exchange rate seems to hold varied results in its effect on the economic growth of a country in the current literature.

Razmi and Refaei (2013) appeared to reaffirm the significance of trade openness on economic growth by noting the relevance of international trade. Razmi and Refaei posited that international trades were hugely beneficial to the residents and organizations of a nation, and by focusing in the production of goods and services, progressed to a complete expansion of welfare, which correspondingly caused production and allocation efficacy. The implication of all this seems to give the appearance that an open economy realizes an advanced economic growth rate in comparison to a closed economy (i.e., no admittance to open trade).

Tchereni and Sekhampu (2013), regarded the human capital of population growth rate as an efficient determinant of economic growth, and superior population growth rates inferred augmented consumption market, which may boost production. Equally, Guga et al. (2015) were concerned about the human capital of the total population growth rate, among others, and its effect on the economic growth of Albania. The authors contended that human capital progression and economic growth were associated and, that economic growth shaped the circumstances for human growth, and human development created openings for economic growth.

Lopez et al. suggest that increased remittances lead to increased demand for both tradable and non-tradable goods, but non-tradable goods' prices are determined in the domestic economy. As a result of the increased demand, relative prices of non-tradable goods rise. This, in turn, causes the real exchange rate to appreciate. As a consequence of higher prices, the non-tradable sector expands since producing non-tradable goods becomes more profitable. This expansion creates a reallocation of labour away from the tradable sector which, in turn, shrinks. The reduction of the tradable sector negatively impacts the international competitiveness of the remittance-receiving country. The loss of competitiveness further fosters the decline in production of other tradable goods.

METHODOLOGY

Model Specification:

This research assumes the macroeconomic variables of FDI, Gross Capital Formation, Exchange Rate, Remittances, Openness to Trade, **Population growth rate,** Domestic Credit Rate and the Dummy Variables WAR and EBOLA significantly affect the economic growth in Sierra Leone from

1980-2018. Thus, given the macroeconomic determinants of economic growth, hypothesizing a growth model generates the following formula:

$$\text{RGDP growth} = f(\text{FDI, GCF, PR DCR, EXR, POP, OPE, Dummy Variables}) \ldots\ldots\ldots\ldots (1)$$

Where RGDP – is a proxy for economic growth, FDI = Foreign Direct Investment; GCF = Gross Capital Formation; EXR = Exchange Rate; POP = Percentage change in population growth; OPE = Trade Openness, DCR= Domestic credit provided by financial sector (% of GDP), DUMMY VARIABLES (WAR & EBOLA) = captures the socio-political and economic effects of instability.

The leading econometric model is a log-log (Guga et al., 2015; Wooldridge, 2013) autoregression, to determine the relationship between economic growth and the selected macroeconomic variables. The log stochastic autoregression equation appears as:

$$\text{Log RGDP growth } t = \alpha_0 + \alpha_1 \text{Log GDPgrowth}_{t-1} + \ldots + \alpha \log qy_{t-q} + e_t \ldots\ldots\ldots\ldots (2)$$

Where

GDP = the log of current GDP measured in dollars; $\alpha 0$ = is a constant or intercept; $\alpha 1$ $LGDPgrowth_{t-1}$ = one lag values of log GDP growth; αqy_{t-q} = the rest of the predictors and their lag values; e_t = the error term, projected as independent and identically dispersed. The model is a multiple regression but with lagged values of LGDP as a predictor. This is to help decide how associated is the GDP growth at time t to its previous values. The addition of the subscript t to the variables is to stipulate they are time-series data. Correspondingly, the a priori expectation of the coefficient estimate for the individual variables in the model includes the following:

$\alpha FDI > 0, \alpha GCF > 0, \alpha PR > 0, \alpha EXR < 0, \alpha POP > 0, \alpha OPE > 0, \alpha DCR > 0, \alpha WAR < 0\ \alpha EBOLA < 0$

Estimation Procedure

Since the focus of this paper is to establish the relationship between macroeconomic determinants and economic growth, an appropriate technique is to adopt Cointegration analysis and error correction modelling. Therefore, the Autoregressive Distributed Lag (ARDL) approach (i.e. the bounds testing approach to Cointegration) popularized by Pesaran and Shin (1999) and Pesaran et al (2001) is used in the study. This approach has some econometric advantages over the Engle-Granger (1987) and the maximum likelihood-based approach proposed by Johansen and Juselius

(1990) and Johansen (1991) Cointegration techniques. Firstly, the bounds test does not require pre-testing of the series to determine their order of integration since the test can be conducted regardless of whether they are purely I(1), purely I(0), or mutually integrated. Second, the ARDL modelling incorporates a sufficient number of lags to capture the data generating process general to specific modelling framework (Laurenceson and Chai, and Jalil, et. al, 2008).

Also, endogeneity problems are addressed in this technique. According to Pesaran and Shin (1999), modelling the ARDL with the appropriate lags will correct for both serial correlation and endogeneity problems. Jalil et al (2008) argue that endogeneity is less of a problem if the estimated ARDL model is free of serial correlation. In this approach, all the variables are assumed to be endogenous and the long run and short-run parameters of the model are estimated simultaneously (Khan et al, 2005). The issue of endogeneity is particularly relevant since the causal relationship between macroeconomic determinants and economic growth cannot be ascertained beforehand. The literature suggests that a bidirectional relationship could exist between the chosen macroeconomic determinants and economic growth.

The ARDL has superior small sample properties as compared to the Johansen and Juselius (1990) Cointegration test (Pesaran and Shin, 1999). Therefore, the approach is considered to be very suitable for analyzing the underlying relationship and has been increasingly used in empirical research in recent years.

An ARDL representation of equation (1) can be specified as follows:

$$\mathbf{\Delta}LRGDP_t = \alpha_{0i} + \sum_{i=1}^{P} \alpha_{1_i} \mathbf{\Delta L}LRGDP_{t-1} + \sum_{i=1}^{P} \alpha_{2_i} \mathbf{\Delta L}FDI_{t-1} +$$
$$\sum_{i=1}^{q} \alpha_{3_i} \mathbf{\Delta L}GCF_{t-1} + \sum_{i=1}^{1} \alpha_{4_i} \mathbf{\Delta L}PR_{t-1} + \sum_{i=1}^{1} \alpha_{5_i} \mathbf{\Delta L}POP_{t-1} + \sum_{i=1}^{1} \alpha_{6_i} \mathbf{\Delta L}EXRT_{t-1} +$$
$$\sum_{i=1}^{1} \alpha_{7_i} \mathbf{\Delta L}DCR_{t-1} + \sum_{i=1}^{1} \alpha_{8_i} \mathbf{\Delta L}OPE_{t-1} + \sum_{i=1}^{1} \alpha_{9_i} \mathbf{\Delta}WAR_{t-1} + \sum_{i=1}^{1} \alpha_{10_i} \mathbf{\Delta}EBOLA_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots (3)$$

Where; Δ is difference operator, p is the lag length and ε_t is assumed to be serially uncorrelated. $\boldsymbol{\alpha_{1_i}}, \boldsymbol{\alpha_{2_i}}, \boldsymbol{\alpha_{3_i}} \ldots\ldots \boldsymbol{\alpha_{ni}}$ are the short-run dynamic coefficients of the model's adjustment long-run equilibrium. The model is selected based on the Akaike Information Criterion (AIC). The AIC uses the smallest possible lag length and is therefore described as the parsimonious model. Once the Cointegrating relationship is ascertained, the long run and error correction estimates of the ARDL

model are obtained. The diagnostic test statistics of the selected ARDL model can be examined from the short-run estimates at this stage of the estimation procedure. Similarly, the test for parameter stability of the model can be performed. The error correction representation of the series can be specified as follows:

$$\Delta LRGDP_t = \alpha_{0i} + \sum_{i=1}^{p} \alpha_{1_i} \Delta LRGDP_{t-1} + \sum_{i=1}^{p} \alpha_{2_i} \Delta \mathbf{L} FDI_{t-1} + \sum_{i=1}^{q} \alpha_{3_i} \Delta \mathbf{L} GCF_{t-1} + \sum_{i=1}^{1} \alpha_{4_i} \Delta \mathbf{L} PR_{t-1} + \sum_{i=1}^{1} \alpha_{5_i} \Delta \mathbf{L} POP_{t-1} + \sum_{i=1}^{1} \alpha_{6_i} \Delta \mathbf{L} EXRT_{t-1} + \sum_{i=1}^{1} \alpha_{7_i} \Delta \mathbf{L} DCR_{t-1} + \sum_{i=1}^{1} \alpha_{8_i} \Delta \mathbf{L} OPE_{t-1} + \sum_{i=1}^{1} \alpha_{9_i} \Delta WAR_{t-1} + \sum_{i=1}^{1} \alpha_{10_i} \Delta\, EBOLA_{t-1} + \text{ɤECTt} - 1 + \varepsilon_t \ldots\ldots\ldots (4)$$

Where

ECT=(Y_{t-1}-φV_t), the error correction term, $\boldsymbol{\varphi} = \sum_{i=1}^{p} \boldsymbol{\beta}$, is the long-run parameter

ɤ= (1- $\sum_{i=1}^{p} \boldsymbol{\alpha}$**),** speed of adjustment parameter with a negative sign. The coefficient of the lagged error correction term (ɤ) is expected to be negative and statistically significant to further confirm the existence of a Cointegrating relationship.

The Bounds test to Cointegration uses the F-statistic in checking the existence of the long-run equilibrium among the variables. The null hypothesis of no Cointegration thus (H_0:ρ_1=ρ_n=0) is verified against the alternative hypothesis of the presence of a long-run relationship, hence Cointegration relationship (H_1: $\rho_1 \neq \rho_n \neq 0$). The test uses the F-statistic in comparison with the critical value bounds which depends on the stationarity properties of the variables, thus a mixture of I(0) and I(1). This approach provides two bounds within which Cointegration decisions are based. The upper bound assumes all series to be I(1) while the lower bound assumes all series are I(0). After obtaining the computed F-statistics, if it is greater than the upper bound critical value, then a conclusion can be drawn that there is an existence of a long-run relationship among the variables, hence Cointegration. On the other hand, there will be no evidence of the existence of Cointegration if the F-statistic estimated is less than the lower bound value. In a case where the F-statistic falls between the upper and lower bound critical values, no conclusive inference can be made.

Data Description

To determine the impact of the macroeconomic determinants on GDP growth for the research period of 1980-2018, annual time series data were employed. Since the model was a log log model

all the variables were transformed into their natural logarithms. Population growth, Foreign Direct Investment, and Gross Capital Formation had negative values as such they were rebased with scalers K=+1, k=+30, and k=+3 respectively. This allowed for the removal of negative numbers and for the logarithmic process to be possible without structural breaks. The mean of these variables changed but their variance remained the same. This ensured that the integrity of the results is intact. The data include the following;

The Real GDP growth is the real annual GDP growth rate and serves as a proxy for economic growth. The utilization of the GDP growth is essential, to capture real growth in productive capacity and measure welfare (Javed et al., 2014; Karuranga, 2010).

The exchange rate (EXR) determinant is the country's official effective exchange rate to the dollar computed by the bank of Sierra Leone.

The applicable trade openness (OPE) variable is a measurement of the sum of the export of goods and services and the import of goods and services all (constant 2010 US$) as a proportion of GDP at market prices (constant US$), following a similar concept by Nsiah et al. (2016).

The annual average growth rate of the total population becomes the proxy for the human capital (POP) element in the current research. Guga et al. (2015) had previously realized the significance of population growth in economic development when they noted a population upsurge signified an augmented participation of the labour force.

Remittances represent personal remittances received as a percentage of GDP. Remittances are a stable source of income, compared to other financial flows, since they are compensatory and thus countercyclical. This countercyclical effect of remittances might reduce the probability of financial crises.

Gross Capital Formation denotes the availability of the various factors of production excluding labour in an economy. The study uses gross fixed capital formation as a measure of capital stock. The gross capital formation (GCF) utilized in the current research is the gross capital formation as a percentage of GDP, following a similar application by Adeleke (2014).

Domestic credit rate that is Credit to the private sector put simply resources given to the private sector by the financial sector. These resources may come in various forms including, loans, trade

credits and non-equity purchases. The study measures credit to the private sector as a share of GDP.

Foreign Direct investment is the net inflows of investment in any economy other than that of the investor purposely to obtain long-term control related to management issues. The study uses FDI inflows as a percentage of GDP to measure foreign direct investment.

The dummy variable WAR takes the value of 1 in the period of the civil war (1991-2001) and zeroes otherwise, EBOLA takes the value of 1 during the Ebola years (2014-2015) and 0 otherwise. The World Development Indicators of the World Bank is the data source for all the macroeconomic variables.

EMPIRICAL ANALYSIS

Unit Root Test

Even though the bounds test for Cointegration does not require pre-testing of the variables for unit root, but this test must be conducted to ensure that the series are not integrated of an order higher than one. This approach is necessary to avoid the problem of spurious results. The Augmented Dickey-Fuller (ADF) test is employed. The Akaike Information Criterion (AIC) is used to determine the optimal number of lags included in the test. The results of the ADF test are reported in **table 01**.

The results suggest that all the variables are integrated of order one i.e. stationary after first difference except LGCF, LEXRT, and LOPE which are stationary in levels. This justified the ARDL bounds approach to determine the long-run relationships among the variables.

Table 01: Unit Root Test

Variable	Lag	ADF test statistic (intercept with no trend)		ADF test statistic (intercept with trend)	
		Level	First Difference	Level	First Difference
LRGDP	1	-0.306130	-5.028290	-2.118945	-5.391935
LFDI	1	-5.438483	-6.798087	-6.356291	-6.710485
LGCF	1	-2.298750	-10.94713	-2.501942	-10.85226

LPR	1	-1.442249	-6.142488	-2.146146	-6.096054
LDCR	1	-2.379608	-5.424759	-2.993054	-6.666880
LEXR	1	-3.086362	-3.025443	-1.808358	-4.767212
LPOP	1	-4.073879	-3.614656	-4.181887	-3.568328
LOPE	1	-2.539415	-5.832340	-3.729604	-5.706259
WAR	--	--	--	--	--
EBOLA	--	--	--	--	--

Cointegration Analysis

Given a relatively small sample size (38) and the use of annual data, a lag length of 1 is used in the bounds test. For annual data, Pesaran and Shin (1999) suggest a maximum of 2 lags (see also Narayan, 2004; and Narayan and Siyabi, 2005). The results of the bound test are given in table 2. The critical values used in this paper are extracted from Narayan (2004).

Table 02 Bounds test results

Test-statistics	Value	Lag		Bound Critical values (restricted intercept and no trend)*	
			SIGNIFICANCE LEVEL	I(0)	I(1)
F-Statistic	15.18749	1	1%	2.5	3.68
			5%	**2.04**	**2.08**
			10%	1.8	2.8

* Base on Narayan (2004)

The F-statistic for the model is **15.18749,** which is greater than the upper critical bound **(2.08)** at the 5 per cent significance level. This suggests that there is a long-run relationship between GDP and the chosen macroeconomic variables. When LGCF, LFDI LEXRT, LPOP & LPR are taken as dependent variables a long run convergent relationship is also established. Thus, the results imply that the Cointegrating relationship between real GDP and the explanatory variables is not unique.

Static Long-Run Results

The existence of a long-run relationship among real GDP and its explanatory variables suggests the estimation of long-run coefficients and short-run dynamic parameters. The estimation of the ARDL model is based on the Akaike Information Criterion (AIC). The static long-run results and the diagnostic test statistics of the estimated model based on short-run estimates are reported in table 03.

Foreign Direct Investment (LFDI) have the expected positive sign but does not exert statistically significant effects on long-run GDP growth. The coefficient estimate of FDI, therefore, conforms to the a priori anticipation of a positive association with economic growth. This results, however, disagrees with Mansaray (2013) who also found that FDI has significant impacts on GDP growth in Sierra Leone even though his research had a shorter period. The facts that FDI is not significant in the long run static model could be explained by the facts that Most FDI coming to Sierra Leone goes into the mining sector which creates short term booms but not significant in the long run as spillovers tend to be fleeting and environmental problems long afterwards persists, destroying local economies such as farming.

Gross Capital Formation (LGCF) have the expected positive sign and exert statistically significant effects on GDP growth. This result agrees with Mansaray (2013) who also found that Gross capital formation has significant impacts on GDP growth in Sierra Leone, which is consistent with the a priori expectation. This principally implies a 1% increase in gross capital formation will lead to about 0.118930% increase in the economic growth of Sierra Leone. The findings support the recognition that, enhancing the scope of investment improves output, which has a run over impact on economic realization. The positive and significant impact of GCF on economic growth is consistent with some of the findings in the literature (Adekele, 2014; Eregha, 2015)

The Exchange rate (LEXRT) has a NEGATIVE sign and statistically significant in explaining GDP growth. This DISAGREE with the findings of Mansaray (2013) who found that exchange rate exerts a significant and positive impact on GDP growth. This result shows that the exchange rate has an inverse relationship to RGDP growth. This means that holding all other factors constant a 1% Depreciation of the Leones relative to the dollar will lead to a DECLINE OF RGDP growth of 0.437% in the long run. By implication, using expansionary monetary policy to fund government

domestic debts, for example, leads to inflationary pressures on the value of the Leones and have a negative impact on RGDP growth. This is explained by the facts that Sierra Leone is largely an imports dependents economy as such depreciation of the Leones means less purchasing power by the public for imported goods and services. This then leads to a fall in aggregate domestic aggregate demand which lowers economic activity. The effect is a fall in RGDP. The NEGATIVE and significant effect of the real exchange rate on economic growth is consistent with the a priori expectation of the current research.

Population growth (LPOP) has the expected positive sign and exert a statistically significant impact on long term RGDP growth. This contradicts the findings of Mansaray (2013) who found that population growth exerts a significant and negative impact on GDP growth. This is consistent with the a priori expectation of a positive association of population growth with economic growth.

Surprisingly, Openness to trade had a negative sign on long-run GDP growth but does not exert a statistically significant impact on RGDP growth. By implication, trade liberalization has a negative but insignificant effect in growing the economy of Sierra Leone in the study period under review. This contradicts the findings of Mansaray (2013) who found that trade liberalization exerts a significant and positive impact on GDP growth. This new result shows that data on the pros and cons of trade liberalization is inconclusive for the period under review.

Domestic credit rate (LDCR) as a percentage of GDP had a negative sign on long-run GDP growth and exert a statistically significant effect on RGDP. This could partly be explained the fact that loans in Sierra Leone tend to be non-performing. Besides, expansion of the domestic credit tends to fund business that are imports oriented and this adds exchange rate pressures which we now know have a negative impact on RGDP growth.

The empirical results show that Private Remittances (LPR) as a percentage of RGDP exert negative and statistically significant effects on RGDP. This could be due to the facts that inward remittance flows can lead to a real exchange rate appreciation, known as the Dutch Disease effect. Despite the positive contribution of remittances to poverty and household welfare, remittances, in this case, had a negative effect on exchange rate appreciation and perhaps export competitiveness.

The dummy variable for the recent Ebola outbreak has the expected negative sign but did not have a statistically significant impact on economic growth in the long run. Whilst the dummy variable War is statistically significant but does not exert any negative impacts on long-run RGDP growth.

Table 03: Long-run Estimates based on AIC- ARDL (1,1,1,1,0,1,1,0,1,1)
Dependent Variable is LRGDP

Variable	Coefficients	Standard error	t-ratio
LGDP(-1)	0.868441	0.075003	11.57874***
LFDI	0.030579	0.032408	0.943579
LGCF	0.118930	0.027560	4.315317***
LPR	-O.077923	0.018903	-4.122306***
LDCR	-0.222608	0.055525	-4.009126***
LEXR	-0.436961	0.091442	-4.778574***
LPOP	0.967052	0.194927	4.961107***
LOPE	-0.132538	0.089407	-1.482411
WAR	0.267085	0.097783	2.731421**
EBOLA	-0.074590	0.070579	-1.056832

Diagnostic test

			P-values
R-squared	(0.993853)	Serial Correlation (LM Test)	(0.0627)
Adjusted R-Squared	(0.988629)	Heteroscedasticity	(0.8529)
Normality Test (Jacque Bera)	(0.554645)	Joint significance (F-Statistics)	(0.000000)

Authors own computation
*Note: ***,**, * imply significant at the 1, 5 and 10 percent levels respectively.*

Short-Run Dynamics

The results of the short-run dynamics associated with the ARDL (1,1,1,1,0,1,1,0,1,1) are reported in table 04. The coefficient of the lagged error correction term (-0.131559) is negative and statistically significant at the 1 per cent level.

The negative and significant coefficient is an indication of Cointegrating relationship among GDP growth, and the chosen explanatory variables. The magnitude of the coefficient implies that 13 per cent of the disequilibrium caused by previous year's shocks converges back to the long-run equilibrium in the current year.

Table 04: Short Run Dynamic Results

Variable	Coefficients	Standard error	t-ratio
d(LFDI)	0.030579	0.014959	2.044212*
d(LGCF)	0.118930	0.014718	8.080407***
d(LEXR)	-0.436961	0.034593	-12.63160***
d(LPOP)	0.967052	0.078510	12.31762***
D(LOPE)	-0.132538	0.043561	-3.042604***
D(WAR)	0.267085	0.046097	5.793976***
D(EBOLA)	-0.074590	0.042623	-1.750004*

Diagnostic test

R-squared	(0.936270)	Mean dependent var	(0.034511)
Adjusted R-Squared	(0.921399)	S.D. dependent var	(0.210873)
SE Regression	(0.059120)	Akaike info criterion	(-2.633828)
Sum of squared residuals	(0.104856)	Schwarz criterion	(-2.289073)
Log likehood	(58.04274)	Hannan-Quinn criterion	(-2.511167)
Durbin-Watson stat	(2.450903)		

Authors own computation

Note: ***,** ,* imply significant at the 1, 5 and 10 percent levels respectively.

The results of short-run dynamic coefficients indicate that the variables have the expected signs as in the long run. Gross capital formation is positive and statistically significant at the 1% level whilst FDI and has the expected positive sign but only significant at the 10% level in the short run.

Short-run changes in the exchange rate index have a negative and statistically significant effect on economic growth at the 1% level just as it is with the long run. This implies that RGDP growth is very sensitive to short term fluctuations in the Leones. The coefficient of short-run change in the population growth on GDP is also positive and statistically significant at the 1% level. This is self-evident that rising population leads to an increase in demand for goods and services in the short run and principle good for RGDP growth.

Openness to trade has a negative and statistically significant impact on RGDP growth. This is can largely be explained by the fact that in the short run Foreign firms tend to disrupt and upend the dominance of domestic firms which causes loss of market share, profitability and causing redundancies.

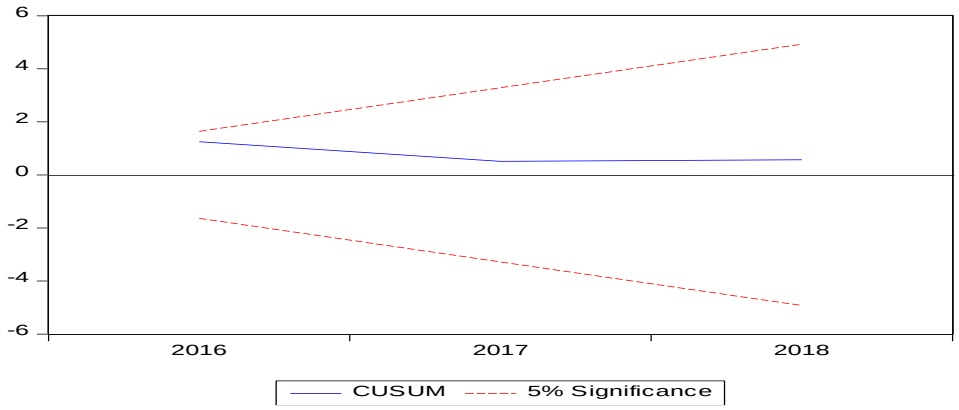
The dummy variable war is statistically significant but exert no negative impact on short-run RGDP growth dynamics. Whilst the dummy variable Ebola had a negative impact on short-run RGDP growth but statistical significance is only attained at the 10% LEVEL.

Diagnostic and Stability Tests

The diagnostic tests of the estimated ARDL (1,1,1,1,0,1,1,0,1,1) model suggest that the model passes the tests of serial correlation, functional form misspecification and non-normal errors and there exists no problem of heteroscedasticity.

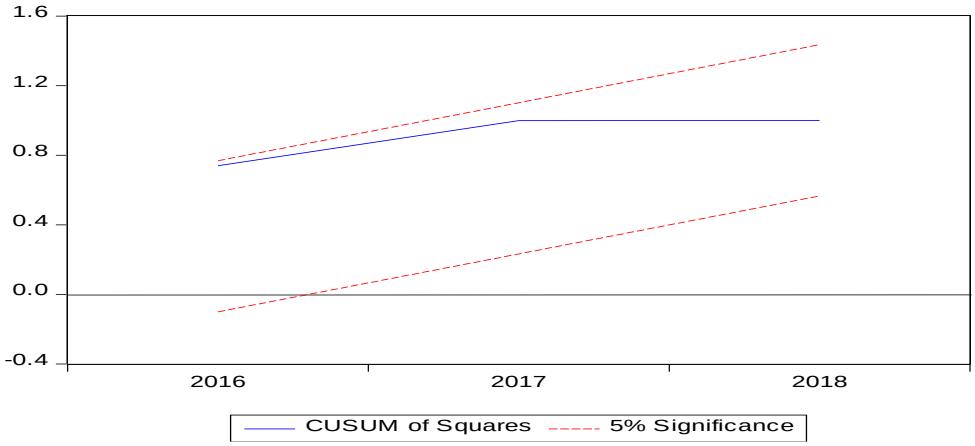
The plots of the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) stability tests as shown in figure 01 and 02 indicate that all the coefficients of estimated model are stable over the study period as they fall within the critical bounds of the 5% significance level.

Figure 01: Plot of Cumulative Sum Recursive Residuals



The straight lines represent the critical bounds at the 5% significance level

Figure 02: Plot of Cumulative Sum of Squares Recursive Residuals



The straight lines represent the critical bounds at the 5% significance level

CONCLUSIONS AND POLICY RECOMMENDATIONS

The current research focused on the macroeconomic determinants of economic growth in Sierra Leone. The results established the existence of an association between economic growth and the chosen macroeconomic determinants.

From the empirical results obtained the following recommendations can be proffered.

- Foreign direct investment and gross capital formation had positive and statistically significant relationships with economic growth in the autoregressive distributed lag model. As such, policymakers in Sierra Leone should stimulate policies that would sustain these macroeconomic elements. To attract more investors into the country, to secure resourceful labour at an economical cost to upsurge its employment. Policies such as business tax breaks could serve as an incentive for investment in Sierra Leone, which can increase production and spillover to the local economy.
- The official exchange rate had a negative impact on RGDP growth. This essentially means that monetary policymakers must ensure that the continuous depreciation of the Leones is put under control. Whilst the fiscal policy arm should design policies increase exports and decrease imports to stabilize the exchange rate. Put simply, policymakers in Sierra Leone should stimulate monetary and fiscal policies to curb rising prices and currency fluctuations, weak exports and imports dependency.
- The total population growth rate as a proxy for human capital in the current research was positive and statistically significant in the long-run and short-run models. The significance could be because population growth is normally followed by skills improvements and increased productivity. Therefore, policymakers in Sierra Leone should stimulate policies to improve the education and work skills to make its population more efficient, because superior population growth rates induce increased consumption market, which may enhance production and economic growth.
- Trade openness in the current research was negative and statistically significant in both the static and dynamic models. Even though free trade has stimulated several gains, this an indication that if the current liberalization policies continue without care, this could hurt

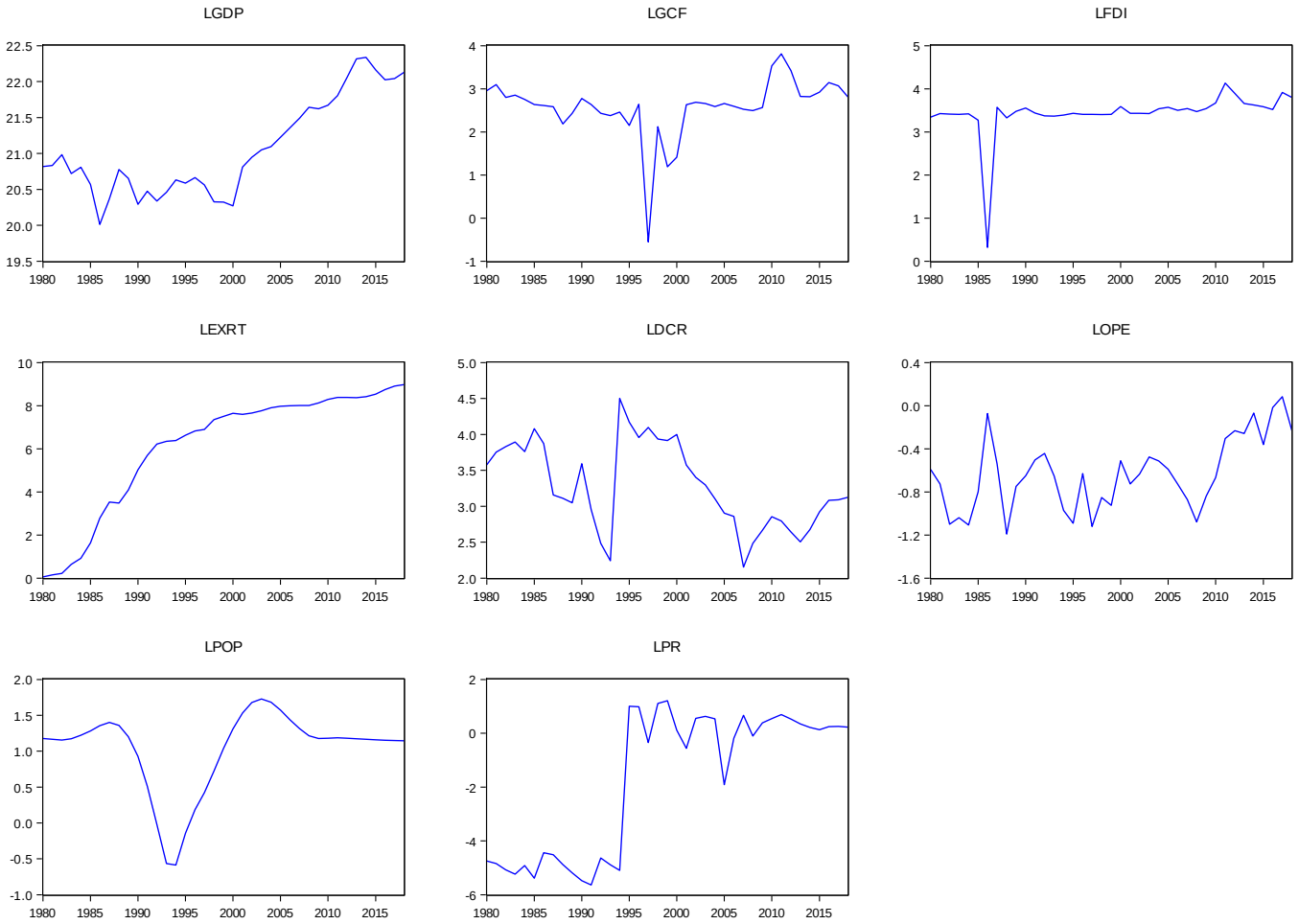
the country's nascent industries. Therefore, policymakers must be very careful with the sectors they open up to foreign competition.

- Private remittances received as a percentage share of GDP has a negative and statistically significant effect of RGDP growth in the long run static model. This could be due to the peculiar institutional arrangement of the forex business in Sierra Leone. Actual foreign currencies are not routinely paid to recipients of remittances but instead given Leones. In cases where people do receive the forex it largely facilitates consumption of imported goods which causes negative trade balance and distorting GDP growth. Therefore, the Bank of Sierra Leone must regulate the forex sector to ensure that people receive their remittances in foreign currency as this would add to the economy's supply of foreign exchange.
- Domestic credit provided by the financial sector as a percentage of GDP has a statistically negative impact on RGDP growth in both the static long-run model and dynamic short-run model. This could be explained by primarily two factors; the first is an increase in loanable funds offered by the financial sector in import-dependent economies leads to an increase in the money supply and usually leads depreciation of the value of the domestic currency which tends to hurt consumption and domestically driven investment. Moreover, Sierra Leonean loans tend to be non-performing. Therefore, loans must be targeted at export oriented industries. Moreover, financial audit and risk analysis must be thoroughly performed by the financial sector to avoid the risk of non-performing loans.

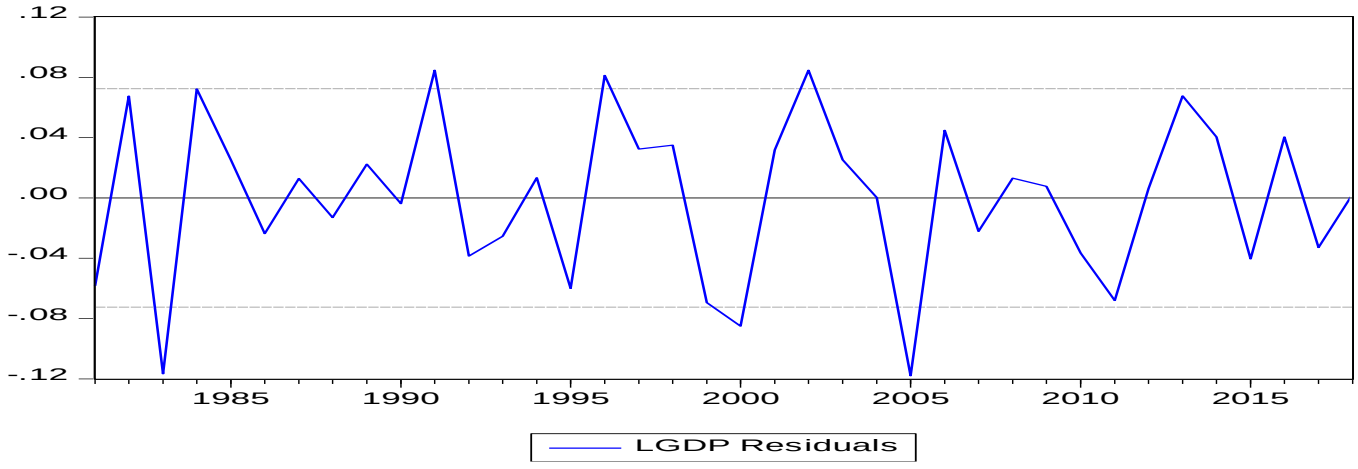
Even with these policy recommendations, the research is not without its limitations. In particular, the research was limited to mostly macro-fiscal variables, future research must also look at the impact of macro monetary variables such as Money supply. Finally, I hope it helps fill the imperfect information in the current literature relating to the determinants of economic growth in Sierra Leone and help generate applied inferences for policymakers.

Appendices

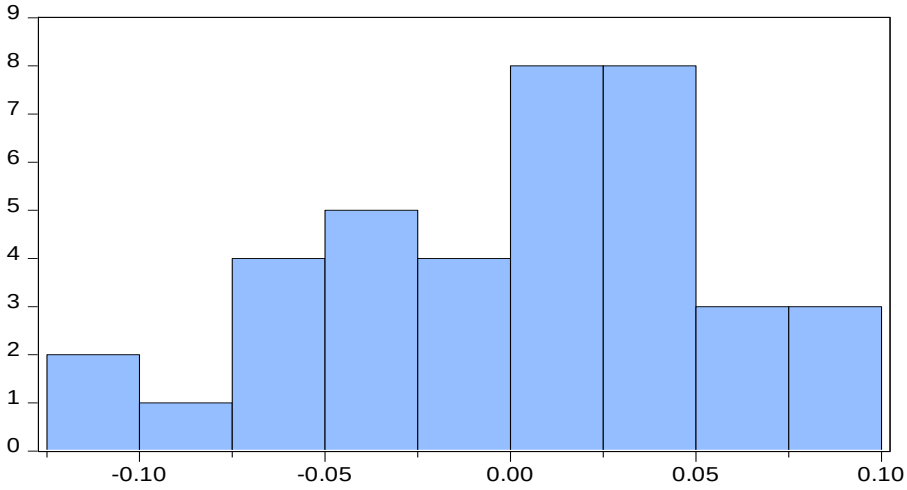
- Logarithmic trend graphs for the chosen macroeconomic variables.



- A plot of the residuals for Real Gross Domestic Products.



- The Jarque-Berra Normality Histogram for the ARDL model



Series: Residuals
Sample 1981 2018
Observations 38

Mean	-1.49e-15
Median	0.006903
Maximum	0.084668
Minimum	-0.117963
Std. Dev.	0.053235
Skewness	-0.368499
Kurtosis	2.551253
Jarque-Bera	1.178854
Probability	0.554645

- The Summary Statistics Of The Chosen Macroeconomic Variables

	LGDP	LGCF	LFDI	LEXRT	LDCR	LOPE	LPOP	LPR
Mean	21.05755	2.570004	3.434603	6.101177	3.282738	-0.635769	1.028149	-1.736933
Median	20.81920	2.633560	3.432765	7.497870	3.123040	-0.651279	1.174944	-0.104054
Maximum	22.33573	3.807488	4.131981	8.978614	4.500305	0.083964	1.728053	1.211299
Minimum	20.01029	-0.552269	0.318995	0.048597	2.152901	-1.192344	-0.587155	-5.638107
Std. Dev.	0.671155	0.694734	0.540744	2.831267	0.601363	0.335296	0.564142	2.668927
Skewness	0.530490	-2.450483	-4.992223	-1.069769	0.046463	0.274253	-1.564968	-0.399545
Kurtosis	2.004888	12.12230	29.87883	2.732149	1.978340	2.342613	4.789616	1.282083
Jarque-Bera	3.438377	174.2582	1336.011	7.555226	1.710189	1.191151	21.12373	5.833397
Probability	0.179212	0.000000	0.000000	0.022877	0.425243	0.551245	0.000026	0.054112
Sum	821.2443	100.2302	133.9495	237.9459	128.0268	-24.79499	40.09779	-67.74038
Sum Sq. Dev.	17.11704	18.34088	11.11133	304.6107	13.74223	4.272077	12.09374	270.6805
Observations	39	39	39	39	39	39	39	39

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