The effect of inflation and unemployment on economic growth: evidence on Sierra Leone.

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Abstract

The main purpose of this study is to investigate the effect of inflation and unemployment on economic growth in Sierra Leone. Using a quarterly time series data, the study adopted the Autoregressive Distributed Lag (ARDL) model for the purpose of estimation and result analysis. Through the ARDL Bounds test for cointegration, the study established the existence of a long-run relationship in the model, and as a result, both a long-run and short-run ARDL models were estimated. From the long-run results, it was revealed that the effect of Inflation (Inf) and unemployment (Unem) on economic growth in Sierra Leone was significantly negative.). For the short-run, an ARDL with lag structure of (2, 2, 0, 1, 2) was used. In this model, the ECT reinforced the existence of a long-run as it was found to be negative and statistically significant. Unlike Unem, the first lag of economic growth (RGDP (-1)), Inf and Inf (-1) were found to have an effect on economic growth in Sierra Leone in the short-run. Based on the findings, it recommended that credible inflation targeting policies must be pursued by monetary authorizes while the government should create opportunities through which the skills and capacity of the population can be fully enhanced.

Keywords: Economic growth, Inflation, Unemployment, ARDL.

JEL: E01, E31, J64

1. Introduction

The primary objective of every nation is to achieve economic growth and development. Economic growth refers to the increase in a nation's wealth over time, which is typically measured by the growth in the production of goods and services. Economic growth has various benefits for countries, such as higher income, improved standard of living, better healthcare, and enhanced education. It also strengthens a country's fiscal position, enabling governments to support poverty reduction programs and enhance societal welfare. Sustainable growth plays a vital role in economic development.

To ensure sustainable growth, it is crucial to achieve low and stable levels of inflation and unemployment (Castellet and Domingo, 1997). Therefore, Understanding the relationship between inflation, unemployment, and economic growth is essential for policymakers, economists, and analysts.

While there is no standard theoretical link between inflation and economic growth, scholars have put forward various theories to explain the potential implications of high or low inflation rates. These theories often differ based on whether they focus on the short-run or long-run effects. In

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the short-run, high inflation levels can be associated with faster economic growth due to increased aggregate demand (Motley, 1994). However, if high and unstable inflation persists in the long-run, it can lead to market uncertainty, reduced investment, and inefficient utilization of productive resources. In any case, inflation ultimately creates macroeconomic instability and imposes significant costs on the economy.

Similarly, high unemployment rates indicate underutilization of human resources and can negatively affect economic productivity and development. The relationship between economic growth and unemployment can be explained by Okun's Law, which states that growth leads to a reduction in unemployment and an increase in employment. While the specific impact is likely to vary across countries, Okun's Law provides an estimate of how much of a country's gross domestic product (GDP) may be lost when the unemployment rate exceeds its natural rate.

As a country, Sierra Leone has been pursuing policy actions to promote rapid and stable growth, reduce poverty and inequality, and achieve macroeconomic stability through job creation. However, the country's growth rates have been inconsistent. According to statistics from the World Bank, between 2000 and 2020, Sierra Leone's average growth rate was 5.5 percent, slightly above the Sub-Saharan Africa average but lower than countries like Ghana, Ethiopia, Kenya, and Rwanda. The economy is also affected by low investment levels, high unemployment, and macroeconomic instability characterized by a weak exchange rate and high inflation.

Given that inflation and unemployment are key indicators influenced by monetary policy, it is crucial for policymakers to understand their relationship with economic growth in Sierra Leone. The lack of consensus in the literature and evidence in the context of Sierra Leone[3] make this study highly relevant and timely.

Therefore, the current study primarily aims to investigate the effect of inflation and unemployment on economic growth in post-war Sierra Leone. Henceforth, the study is driven by the following research questions:

i. What is the impact of inflation and unemployment on economic growth in Sierra Leone?
ii. Is there a long-run relationship between inflation, unemployment, and economic growth in Sierra Leone?
iii. Is there any causality among the variables?

The study proceeds as follows: in Section Two, a stylized fact about growth, inflation and unemployment in Sierra Leone. Section Three primarily presents a review on both the theoretical and empirical literature. Section Four presents the methodology of the study. This is swiftly followed by Section Five which is dedicated to the presentation and analysis of the study result, while Section Six is the conclusion.

2. Stylized Facts about Growth, Inflation and Unemployment in Sierra Leone

[3] To the best of our knowledge, only a study by Swaray (2011) was found to analyze the relationship between inflation and economic growth in Sierra Leone.

Economic Growth Trend

Sierra Leone, located on the West Coast of Africa, is categorized as one of the least developed countries globally. Since gaining independence in 1961, the nation has demonstrated remarkable resilience despite facing numerous challenges. While the economy performed relatively well from the 1960s to the 1980s, it suffered a significant setback during the civil war in the 1990s. In the years following the war, Sierra Leone endured additional shocks, including the Ebola outbreak and the ongoing COVID-19 pandemic. Nonetheless, the country has witnessed commendable growth in the post-war period.

As depicted in Figure 2.1, although there have been fluctuations in growth rates over the years, Sierra Leone achieved an average annual growth rate of around 5.5 percent between 2000 and 2020, surpassing the Sub-Saharan Africa (SSA) average of 4.3 percent. The trend remained relatively stable. Following the war, growth surged to approximately 26 percent in 2002, driven by the resumption of mining activities and investments in the telecommunications sector (UNCTAD, 2010). Subsequently, growth moderated to an average of 6 percent from 2003 to 2011. However, between 2012 and 2014, growth soared to around 13 percent, largely due to investments in the mining sector by African Minerals and London Mining (Madsen, 2015). Unfortunately, this impressive growth was short-lived as a result of the decline in global iron ore prices, leading to the closure of these companies. Moreover, the outbreak of Ebola further exacerbated the situation, causing a sharp decline in growth, reaching a negative 20 percent in 2015. However, as the country regained its Ebola-free status, investor and business confidence started to recover. From 2016 to 2019, Sierra Leone averaged approximately 5 percent growth before experiencing negative growth in 2020 due to the onset of the COVID-19 pandemic.

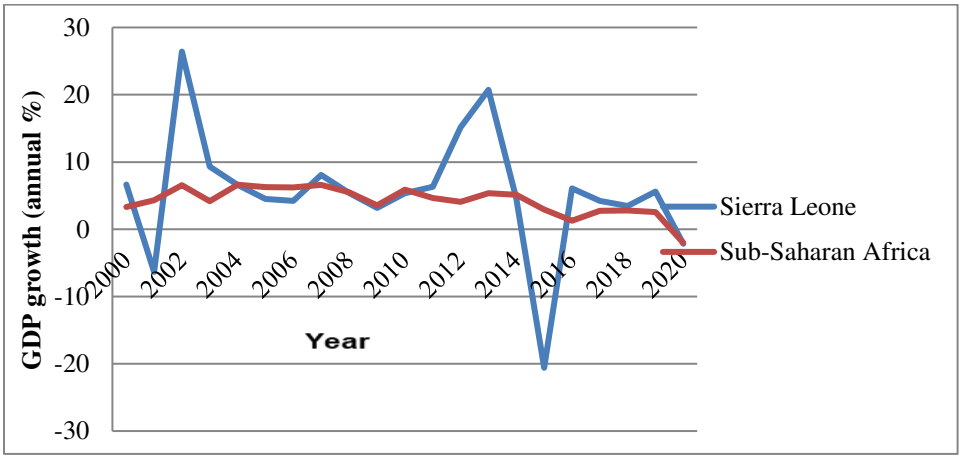

Figure 2.1: Trend in GDP growth (2000-2020)
Source: WDI (2021)

Majority of this growth according to the statistics accrue from the Agriculture sector in terms of contribution to GDP. This sector, over the years, accounted for more than half of the contributions to GDP (Figure 2.2). The service sector follows after accounting for around 35 percent of GDP from 2016 to 2020 and over the same period, the industry sector accounted for around 10 percent.

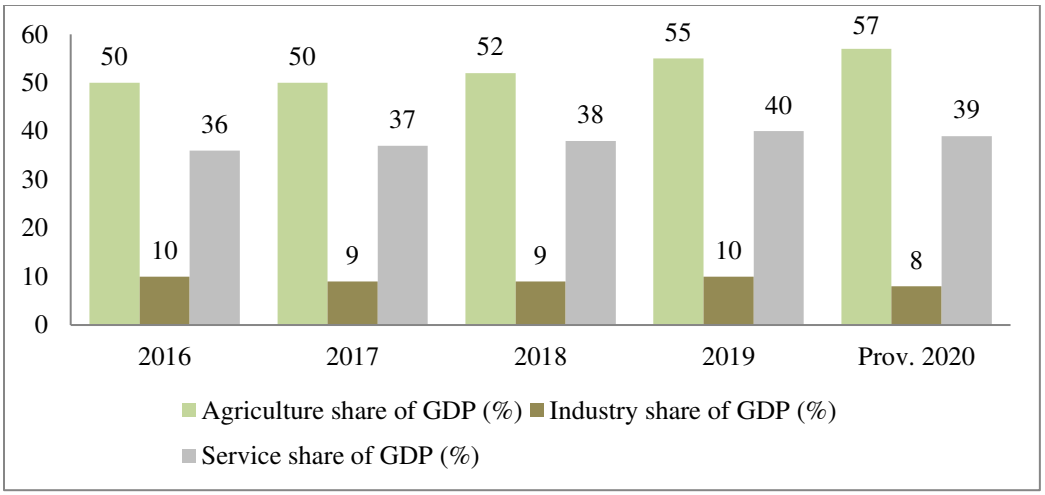

Figure 2.2: Contribution to GDP by sector Share (2016-Prov. 2020)

Source: Stats SL (2020)

Inflation Trends

Generally, inflation is considered among the most important macroeconomic indicators to assess the strength of a country's economy. In Sierra Leone, however, this indicator, over time, has been attaining undesirable levels. Periods just after the war, between 2000 and 2003, the level of inflation was around 1.4 percent before jumping into double digit from 2004 to 2007 (Figure 2.2). Until 2015 since 2008, the country averaged a level of inflation around 7 percent only to double this average for the 2016 to 2020 period. On average, between 2000 and 2020 Sierra Leone's level of inflation was around 9 percent compared to SSA's 5 percent.

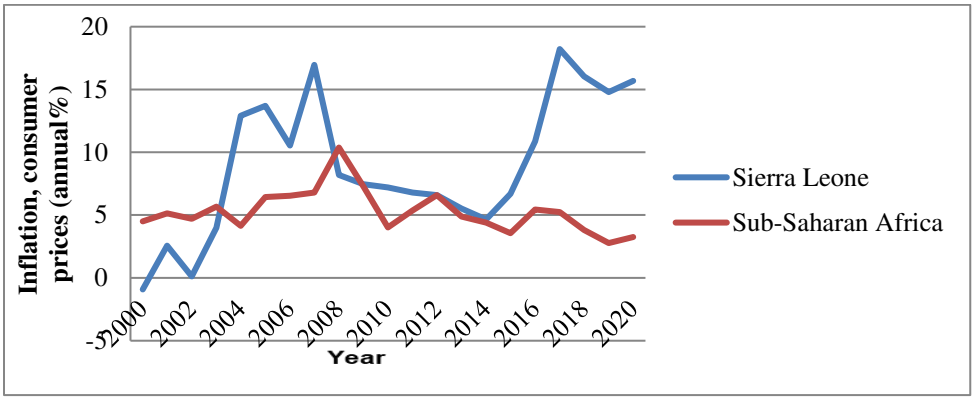

Figure 2.3: Trend in Inflation (annual %) (2000 – 2020)

Source: WDI (2021)

Unemployment Trends

The trend in unemployment rate in Sierra Leone is virtually increasing albeit at a decreasing rate. From 2000 to 2015, unemployment levels accounted for an average of 3.5 percent. Subsequent period, 2010-2020 average around 4.5 percent. Generally, the average unemployment rate in Sierra Leone has stayed below the average rate average SSA rate of unemployment (see Figure 2.3).

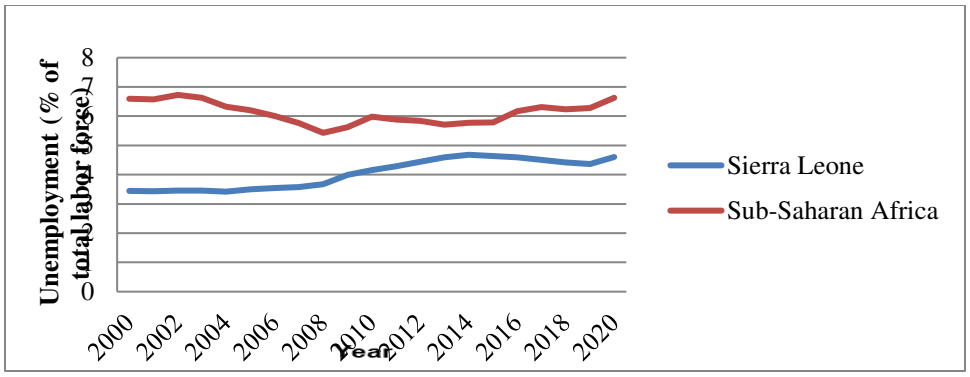

Figure 2.3: Trend in Unemployment in Sierra Leone 2000 – 2020

Source: WDI (2021)

3. Literature Review

While a standard theoretical link between inflation and economic growth seems missing, the relationship between economic growth and unemployment could be prominently traced to Okun's Law. The Law, in the most basic form, advances the argument that growth will cause unemployment to fall and employment to rise (Dayıoğlu and Aydin, 2020). Over the years, this law has been a useful tool for guiding monetary policy as it can be used to forecast or estimate a country's growth rate using the rate of unemployment in the economy.

Empirically, there is no shortage in the literature of the relationship between inflation, unemployment and economic growth. However, while a plethora of work has been done on examining the effect of inflation on economic growth and the effect of unemployment on economic growth, comparatively, only few studies, including Dayıoğlu and Aydin (2020), Ademola and Badiru (2016), Shahid (2014), Jaradat (2013) and Mohseni and Jouzaryan (2016), investigated the effect of inflation and unemployment on economic growth. Furthermore, in the literature, time series data and estimation techniques were mostly used. Nonetheless, the findings lack unanimity hence, suggesting that they vary from country to country. Further discussion on the empirical literature proceeds as follows:

The Effect of Inflation and Unemployment on Economic Growth

Mohseni and Jouzaryan (2016) examined the effects of inflation and unemployment on economic growth in Iran for the period 1996-2012. The author's employed the Autoregressive Distributed Lag (ARDL) Model estimation technique and revealed that inflation and unemployment exerts a significantly negative effect on economic growth in Iran in the long-run, suggesting that economic growth in Iran in the long term could be decreased by high inflation and unemployment rates. Similarly, investigating the effect of inflation and unemployment on economic growth in Pakistan, Shahid (2014) established that inflation and unemployment affects economic growth negatively. However, only the effect of unemployment on economic growth was observed to be statistically significant.

In contrast, using Ordinary Least Square (OLS) and other diagnostic tests, Ademola and Badiru (2016) found inflation and unemployment to have a positive association with economic growth in Nigeria. Other studies, however, found that the effect of inflation and unemployment on economic growth does not always go in the same direction. Jaradat (2013) examined the impact of unemployment and inflation on economic growth for Jordan. Using a linear regression

technique to estimate the relations for a time series data from 2000 to 2010, the Author found the association between unemployment and economic growth to be significantly negative while the opposite was observed for the relationship between inflation and economic growth.

Relying on symmetric and asymmetric reversed causality tests and quarterly time series data (2000Q1-2020Q4), Dayıoğlu and Aydin (2020) examined the relationship between inflation, unemployment, economic growth and current account deficit for Turkey. In the end, the study found an inverse relationship between unemployment and growth rates in Turkey, emphasizing its prominence during crisis periods. Also, the study revealed that a one-way symmetrical causality relationship from negative growth shocks to a negative inflation shocks exist.

The Relationship between Inflation and Economic Growth

In the literature, the relation between inflation and economic is not straightforward with findings varying in terms of effect and significance. For instance, Swaray (2011) examined the relationship between inflation and economic growth in Sierra Leone for the period 1979 to 2008. Using the ARDL approach, the author found the effect of inflation on growth to be negative and a statistically significant in both the long-run and short-run. Also, Barro (2013) used a panel data for around 100 countries from 1960 to 1990 and observed a similar result. In the study, Barro (2013) found that if average inflation is to increase by 10 percentage points, annually, real per capita growth rates would decline by 0.2 to 0.3 percentage points per year while investment to GDP would fall by 0.4 to 0.6 percentage points per year.

Furthermore, looking at a broad cross section of countries, Motley (1994) found that inflation has a great tendency to slow real growth; while Mandeya and Ho (2021), in a study of the nexus between inflation, inflation uncertainty and economic growth found inflation to affect growth negatively in both the short and long-run. Other studies to also found inflation to have a negative effect on economic growth include De Gregorio (1991), Fisher (1993), Castellet and Domingo (1997), Khan and Senhadji (2001), and Iqbal and Nawaz (2009). Conversely, investigating the impact of inflation on economic growth, Umaru and Zubairu (2012) found inflation to have a positive impact on economic growth in Nigeria. Hodge (2006) documented similar effect for South Africa albeit for the short run. Also, Mallik and Chowdhury (2001) evidenced that inflation affects growth positively in Bangladesh, India, Pakistan and Sri Lanka.

Aside from that, since inflation is not bad at all levels, other researchers resorted to investigating the threshold level of inflation for growth (Bawa and Abdullahi, 2012; Fakhri, 2011; Fabayo and Ajilore, 2006; Kremer et al., 2013). For instance, Fakhri (2011) examined the relationship between inflation and economic growth in Azerbaijan, applying a threshold model approach. The author concluded with the existence of a nonlinear relationship between inflation and economic growth, estimating the threshold at 13 percent. In the case of Nigeria, Bawa and Abdullahi (2012) employed a threshold regression model and estimated that the threshold level of inflation in Nigeria to be 13 percent. According to the Authors, below this threshold level, inflation has a mild effect on economic activities but above it the magnitude of the negative effect on growth is high.

The Relationship between Unemployment and Economic Growth

The Unemployment-Growth nexus, often regarded as the Okun's law, has been widely investigated. While others find support for the inverse relationship between unemployment and

growth in line with the predictions of the OKun's law (Ziberi and Avdiu, 2019; Hussain et al., 2006), some have found contradicting evidence (Moosa, 2008; Branda et al., 2016; Mahadea, 2003). Ziberi and Avdiu (2019) investigated the relationship between unemployment and economic growth in Kososvo. Relying on a time series data from 2001 to 2018, the study employed the OLS estimation approach. The result from the study concludes that for a percentage growth in economy, unemployment is decreased by 1.7 percent, thus, lending support to Okun's law. Similarly, with a focus on Pakistan, Hussain et al. (2006) also found the relationship between unemployment and economic growth to be negative.

In contrast, Banda et al. (2016) examined the impact of economic growth on unemployment in South Africa relying on the Vector Error Correction Model (VECM) and found the relationship between unemployment and economic growth to be positive in the long-run. The study revealed that a one percent increase in growth increases unemployment in South Africa by 19 percent. A similar result was observed by Moosa (2008) and Mahadea (2003) thus, failing to find support for Okun's law.

In conclusion, the empirical literature revealed that, while related studies are in abundance, the findings lack consensus. Beyond that, studies on the relationship between inflation, unemployment and economic growth on Sierra Leone are seriously lacking. Against this backdrop, by investigating the effect of inflation and unemployment on economic growth in Sierra Leone, the study seeks to add new knowledge to the debate by bringing onboard the Sierra Leone case.

4. Methodology

To investigate the effect of inflation and unemployment on economic growth in Sierra Leone, the empirical model of the study is specified as follow;

$$RGDP_t = \gamma_0 + \gamma_1 Inf_t + \gamma_2 Unem_t + \gamma_3 Opn_t + \gamma_4 D_t + \varepsilon_t \dots\dots\dots (1)$$

Where *RGDP* is the dependent variable representing Real Gross Domestic Product measured as economic growth; *Inf, Unem, Opn,* and *D* are the regressors representing Inflation, Unemployment, Trade Openness and Dummy variable respectively. The Dummy variable accounts for the war, taking the value one (1) during the war period (1991-2001) and zero (0) when there is no war. The subscript *t* denotes the time dimension, whereas, γ_0 *and* γ_i $(where\ i = 1, 2, \dots, 4)$ represent the intercept and parameters to be estimated; ε_t is the random error term respectively, assumed to be independently and identically distributed with zero mean and constant variance.

The real Gross Domestic Product (GDP) is the dependent variable in the study representing the total annual average growth rates of GDP in per cent, and used to measure economic growth in (see Sahid, 2014; Banda et al., 2016; Mohseni and Jouzaryah, 2016). Inflation (Inf) is measured by the consumer price index's annual growth rate and is expected to have a negative impact on economic growth due to increased uncertainty and reduced investment. Unemployment (Unem) is measured as the total percentage of the total labour force without work but actively seeking employment. It is expected that as a country grows economically, the unemployment decreases based on the inverse relationship suggested by Okun's law. Trade openness (Opn) is the sum of export and import as a percentage of GDP, indicating its degree of economic openness. Higher

trade openness is expected to lead to more growth and investment. The Dummy variable (D) represents the impact of structural breaks, specifically the civil war during the 1990s till the early 2000s. In this study periods of war take the value one (1) and zero (0) otherwise. It is expected that the war had a negative effect on growth.

The study employed quarterly time series data from 1991Q1 to 2020Q1, obtained from secondary sources. It is important to mention that the original annual data was transformed into quarterly time series data. This conversion was performed using the frequency conversion feature in the Eviews statistical software, specifically utilizing the linear low-to-high frequency method. A total of 117 observations were included in the analysis. The data for the series primarily originated from the UNCTAD Stats and the World Bank Economic Output website. Also worthy of a mention is that, with the exception of the dummy variable, all the other variables are in percentages. Consequently, these variables are interpreted and analyzed as elasticities.

Estimation procedure

Unit root Test

According to Glen (2016), a stationary series remains unchanged in shape despite changes in time, indicating the absence of a unit root. Time series data typically exhibit a random walk pattern and tend to be non-stationary. However, using non-stationary variables in regression analysis can lead to misleading results. Therefore, it is crucial to address series stationarity before conducting regression analysis.

While there are several unit root tests, the Augmented Dickey-Fuller (ADF) test, which is widely used, is employed in this study. The ADF test is an extension of the Dickey-Fuller test proposed by Dickey and Fuller (1979). It can be performed in three versions: constant, constant and trend, or none. The main objective of the test is to investigate the null hypothesis that the 'series have unit root' against the alternative hypothesis of 'no unit root'. The decision on the stationarity of a series is made by comparing the *t*-statistic to the critical value. If the null is rejected, then it is concluded that the series is stationary at level. Otherwise, the series is non-stationary and in that case, the series can be differenced and tested again.

The Autoregressive Distributed Lag (ARDL) Model

The study used the ARDL estimation technique to analyzed the effect of inflation and unemployment on economic growth. The ARDL technique is suitable when the series being analyzed are of mixed order, both I(0) and I(1), as it provides realistic and efficient estimates (Nkoro and Uko, 2016). One advantage of the technique is that it allows for lags on both the dependent and independent variable, reducing the possibility of endogeneity.

In addition, the Bounds test can be employed with the ARDL method to determine whether there is a cointegration relationship among the variables. Cointegration indicates the existence of a long-run relationship between the variables. The Bounds test helps establish this relationship. However, selecting the optimal lag length is crucial for conducting the ARDL Bounds test. Various criteria, such as the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQ), and Final Prediction Error (FPE), are utilized to determine the optimal lag.

Finally, the study conducts the ARDL Bounds test by testing the null hypothesis of no cointegration against the alternative hypothesis of cointegration. This test helps determine whether a long-run relationship exists among the variables under investigation. Transforming and specifying equation (1) in an ARDL form becomes;

$$\Delta RGDP_t = \delta_0 + \sum_{i=1}^{p} \beta_{1ti} \Delta RGDP_{t-1} + \sum_{i=0}^{q} \beta_{2ti} \Delta Inf_{t-1} + \sum_{i=0}^{q} \beta_{3ti} \Delta Unem_{t-1} + \sum_{i=0}^{q} \beta_{4ti} \Delta Opn_{t-1} + \sum_{i=0}^{q} \beta_{5ti} \Delta D_{t-1} + \theta RGDP_{t-1} + \alpha_1 Inf_{t-1} + \alpha_2 Unem_{t-1} + \alpha_3 Opn_{t-1} + \alpha_4 D_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where: p and q denote the maximum lag for the dependent and independent variables respectively; Δ indicates the difference operator; δ_0 represents the drift component. In equation (2), the long-run coefficients in the model are represented by $\alpha_i's (i = 1, 2, \ldots, 4)$ while the dynamic components with the $\beta's$ reflect the short-run.

The presence of a long-run relationship is determined using the ARDL Bounds test of cointegration by comparing critical values (representing upper and lower bounds) with the F-statistic. According to a simple rule, if the F-statistic is higher than the critical value of the upper bound at a specific significance level, it indicates the existence of a long-run relationship. In this case, the null hypothesis of no cointegration is rejected. Conversely, if the F-statistic is lower than the critical value of the upper bound, it suggests the absence of cointegration and no long-run relationship in the model.

When the F-statistic exceeds the upper bound's critical value, equation (2) is adjusted to form an error correction model, resulting in a reparametrized ARDL model presented as follows:

$$\Delta RGDP_t = \delta_0 + \sum_{i=1}^{p} \beta_{1ti} \Delta RGDP_{t-1} + \sum_{i=0}^{q} \beta_{2ti} \Delta Inf_{t-1} + \sum_{i=0}^{q} \beta_{3ti} \Delta Unem_{t-1} + \sum_{i=0}^{q} \beta_{4ti} \Delta Opn_{t-1} + \sum_{i=0}^{q} \beta_{5ti} \Delta D_{t-1} + \sigma ECT_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where equation (3) shows a model in first difference that includes an error correction term (ECT). The ECT reflects the model's speed of adjustment for any short-run disequilibrium to the long-run.

Granger Causality

To establish a linear bivariate causal relationship between economic growth and the regressors, the study carried out a granger causality test. Granger causality is a probabilistic method that can be used to investigate causality between two variables in a model (Tarawalie and Jalloh, 2021). This test is conducted through the use of the *F*-test. Adapting from Granger (1969), a bivariate autoregressive model is defined as;

$$RGDP_t = \sum_{j=1}^{s} a_j RGDP_{t-j} + \sum_{j=1}^{s} b_j X_{t-j} + e_t \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$X_{i,t} = \sum_{j=1}^{s} c_j RGDP_{t-j} + \sum_{j=1}^{s} d_j X_{t-j} + \in_t \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where: e_t and $\in_t$ are two uncorrelated white-noise series. From the above equations, (4) and (5), s represents the maximum lag observations in the model and X represents any explanatory variable that is tested against RGDP. From equation (4) and (5), X is causing RGDP if b_j is not equal to zero and vice versa. Similarly, RGDP is causing X if c_j is not equal to zero and vice versa. If both events occur, then a feedback relationship is said to exist between RGDP and X (Granger, 1969).

5. Results and Discussions

Unit Root Test

Table 1 displays the findings of the study regarding trends and no trends. All the series examined in Table 1 were determined to be stationary, although some were stationary at the level, while others required the first difference to achieve stationarity. The levels of significance varied, with some series exhibiting significance at the 1 percent, 5 percent, or 10 percent levels.

Table 1: ADF Unit Root Test

Variable	No Trend		Trend	
	Level	First Difference	Level	First Difference
RGDP	-2.757	-4.181***	-2.427	-4.204***
Inf	-4.701***		-4.752***	
Unem	-1.247	-3.467**	-2.533	-3.512**
Opn	-2.841	-3.973***	-4.043***	

Note: ***, ** and * indicates significance at the 1, 5 and 10 percent level of significance.
Source: Author's computation using output from Eviews 11

When considering the results without trend and only an intercept, it was observed that the variable "Inf" was stationary at level, while "RGDP," "Unem," "Opn," and "D" required the first difference to achieve stationarity. However, when including the trend, "Inf" and "Opn" were found to be stationary at level, while "RGDP," "Unem," and "D" became stationary after taking the first difference. These outcomes from the Augmented Dickey-Fuller (ADF) unit root test align with the use of an Autoregressive Distributed Lag (ARDL) model for estimation, as the ARDL model accommodates series with mixed orders of integration.

Optimal Lag Selection

To determine the most suitable lag for the model, the study employed lag order selection criteria. This step was crucial because using sub-optimal lags can lead to inaccurate estimation results. To mitigate or eliminate this issue, a lag length criteria check is introduced. In this study, the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQ), and Final Prediction Error (FPE) were utilized as lag length criteria. These criteria help assess the quality and fit of different lag lengths.

Considering the nature of quarterly data, the study deemed it appropriate to consider four lags for the model, as supported by previous research. By examining the results presented in Table 2, all the lag length criteria consistently indicated that lag 2 is the optimal lag to be used in the model.

Table 2: Optimal Lag Selection Criteria

Lag	FPE	AIC	SC	HQ
0	546.92	17.66	17.84	17.73
1	0.0023	5.26	5.84	5.49
2	6.13e-05*	1.65*	2.62*	2.04*
3	7.75e05	1.88	3.23	2.43
4	9.47e-05	2.08	3.81	2.78

**Indicates lag order selected by the criterion*
Source: Author's computation

Cointegration Bounds Test

Once it was determined that the series exhibited mixed integration order and were stationary, the ARDL bounds test for cointegration was employed to assess whether a long-run relationship existed among the series. In Table 3 of this study, the cointegration analysis results are presented. According to the findings, the F-statistic (6.54) exceeds the upper bound, I(1), at the 1% significance level. Therefore, this study establishes the presence of a long-run relationship among the variables.

Table 3: Bounds Test for Cointegration

Test Statistics	Value	Significance Level	I(0)	I(1)
F-Statistic	6.536	1%	3.29	4.37
K	4	5%	2.56	3.49
Asymptotic: n=1000		10%	2.2	3.09

Source: Author's computation using output from Eviews 11

ARDL Result Presentation and Analysis

After confirming the presence of a long-run relationship through the Bounds test for cointegration, this study proceeded to present the analysis of both the long-run and short-run ARDL estimated models. Furthermore, the outcome of the Bounds test of cointegration addresses the second research question of the study, which aims to investigate the existence of any long-run relationship. As previously mentioned, all variables, with the exception of the dummy variable (D), are interpreted in elasticity form. The ARDL model was estimated with the determined optimal lag structure of two (2). The discussion of the results is presented in the following manner.

Long-run Analysis

The long-run results are presented in Table 4 of the study. The findings indicate that all variables, namely Inflation (Inf), Unemployment (Unem), Trade Openness (Opn), and the Dummy variable (D), exhibit signs that align with the study's expectations. However, while Inflation, Unemployment, and the Dummy variable are found to be statistically significant, Trade Openness is deemed insignificant.

Based on the results, it is evident that inflation has a negative impact on economic growth in Sierra Leone. At a significance level of 5 percent, a one percentage point increase in inflation leads to a 0.2 percent decline in economic growth in the long-run, assuming other factors remain constant. This implies that as inflation, a crucial macroeconomic indicator, rises, economic growth tends to decrease. This relationship can be attributed to the potential macroeconomic instability associated with higher inflation levels, which may erode investor confidence and diminish consumers' purchasing power, consequently exerting a negative influence on economic growth. Remarkably, this finding aligns with the research conducted by Adaramola and Dada (2019).

Table 4: Long-Run ARDL Estimation Result

Variable	Coefficient	Standard Error	*t*-Statistic	Prob
Inf	-0.204	0.098	-2.087	0.039
Unem	-6.178	3.195	-1.933	0.056
Opn	1.055	0.972	1.086	0.280
D	-6.922	3.290	-2.104	0.038
_Cons	23.128	10.893	2.123	0.036

Source: Author's computation using output from Eviews 11

Likewise, assuming other factors remain constant, it has been observed that a one percentage point increase in unemployment in Sierra Leone leads to a 6.2 percent decrease in long-run economic growth. This result aligns with Okun's law, indicating an inverse relationship between unemployment and economic growth in Sierra Leone. Generally, high unemployment rates indicate a lack of fully utilizing the country's human capital, which can result in workers losing their skills and income, thereby hindering economic growth. This finding supports the research of Mohseni and Jouzaryan (2016) and Shahid (2014).

Additionally, the findings demonstrate that trade openness has a positive impact on economic growth in Sierra Leone. This finding is consistent with the study's initial expectation, suggesting that countries with more liberalized trade policies are more likely to experience economic growth through international trade. However, despite aligning with theoretical predictions and related literature, the relationship was not statistically significant for Sierra Leone.

Finally, as anticipated, the study revealed that the war dummy variable has a negative and statistically significant effect on economic growth in the long run. This finding contradicts the findings of Barrie (2020) but supports the findings of Barrie et al. (2021)

Short-run Analysis

According to the Akaike Information Criterion (AIC), the short-run model was estimated using a lag structure of (2, 2, 0, 1, 2). In contrast to the long-run model, all variables were found to be statistically significant. The results of the short-run model are presented in Table 5. The Error Correction Term (ECT) was determined to be negative and highly significant, suggesting that any short-run disequilibrium from the long-run equilibrium is corrected at a rate of 17 percent per quarter in the model. Furthermore, the results indicate that approximately 73 percent of the variation in the dependent variable is explained by the independent variables, as indicated by the

R-squared value. Additionally, the Durbin-Watson statistic of 2.1 suggests the absence of serial correlation in the model.

The findings reveal that the first lag of the dependent variable, RGD (-1), has a positive impact on economic growth. Specifically, an increase of one percentage point in the lagged value of economic growth leads to a 0.7 percent increase in economic growth in the short run in Sierra Leone, assuming all other factors remain constant. This finding implies that the growth in the current period is positively influenced by the growth in the previous period on a quarterly basis.

Table 5: Short-Run ARDL Estimation Result (2, 2, 0, 1, 2)

Variable	Coefficient	Standard Error	*t*-Statistic	Prob
D(RGDP(-1))	0.705	0.057	12.375	0.000
D(Inf)	-0.344	0.090	-3.826	0.000
D(Inf(-1))	0.190	0.084	2.274	0.025
D(Opn)	-1.091	0.537	-2.032	0.045
D(D)	-35.438	5.236	-6.768	0.000
D(D(-1))	25.675	5.675	4.524	0.000
ECT(-1)	-0.169	0.026	-6.412	0.000
R-Squared			0.733	
Adjusted R-squared			0.718	
Durbin-Watson Stats			2.06	

Source: Author's computation using output from Eviews 11

Similarly to the long-run analysis, inflation is found to have a negative impact on economic growth in the short run. The results indicate that a one percent increase in inflation leads to a 0.3 percent reduction in economic growth, assuming all other factors remain constant. However, the lagged value of inflation exhibits an opposite effect. It is observed that a one percent increase in the first lagged value of inflation results in a 0.2 percent increase in economic growth in the short run, holding all else constant. This suggests that previous quarter's inflation rate positively affects economic growth.

Moreover, trade openness is shown to have a negative influence on economic growth in the short run. Despite contradicting the study's initial expectation, this result is statistically significant. Assuming other factors remain constant, the findings reveal that a one percent increase in trade openness leads to a 1.1 percent reduction in economic growth. Although this outcome aligns with the findings of Lawal et al. (2016), it deviates from the theoretical expectation. Therefore, policymakers should carefully consider the trade sector's behavior and address the short-run negative consequences (Lawal et al., 2016).

Furthermore, the results regarding the war dummy variable in the short run align with the long-run findings, indicating a negative impact of war on economic growth. However, the lagged value of the war dummy variable demonstrates the opposite effect on economic growth.

Granger Causality

The Pairwaise Granger causality test, which answers to the study's research question, is presented in Table 6. From the result, Inf was found to significantly granger cause RGDP but the reverse did not hold true. Similarly, Unem was found to granger cause Opn with the reverse not holding true. However, no granger causality was observed for the following pair of combinations: RGDP and Unem, RGDP and Opn, Inf and Unem, and Inf and Opn.

Table 6: Pairwaise Granger Causality Test

Null Hypothesis	Obs	F-Statistic	Prob
Inf does not Granger Cause RGDP	115	2.892	0.060
RGDP does not Granger Cause Inf		0.186	0.830
Unem does not Granger Cause RGDP	115	0.360	0.698
RGDP does not Granger Cause Unem		0.111	0.894
Opn does not Granger Cause RGDP	115	2.219	0.114
RGDP does not Granger Cause Opn		0.203	0.816
Unem does not Granger Cause Inf	115	0.609	0.546
Inf does not Granger Cause Unem		0.0.006	0.994
Inf does not Granger Cause Opn	115	0.246	0.782
Opn does not Granger Cause Inf		0.115	0.892
Unem does not Granger Cause Opn	115	4.711	0.011
Opn does not Granger Cause Unem		0.806	0.449

Source: Author's computation using output from Eviews 11

Diagnostic tests

The study further carried out diagnostic tests for serial correlation, heteroscedasticity and stability for the estimated ARDL model. Results for both serial correlation and heteroscedasticity are shown in Table 7, while the stability result is shown in Figure 1 and Figure 2. In this study, the null hypothesis of no serial correlation was not rejected under the Breusch-Godfrey Serial Correlation Langrange Multiplier (LM) Test, suggesting that the model does not suffer from the problem of serial correlation. For the heteroscedasticity test, the Breusch-Pagan-Godfrey Heteroscedasticity Test was adopted. From the result, the study failed to reject the null of homoscedasticity, thus, concluding that the variance of the residuals is constant.

Table 7: Serial Correlation and Heteroscedasticity Tests

Statistic	F-statistic	Prob
Breusch-Godfrey Serial Correlation LM Test	0.328	0.721
Breusch-Pagan-Godfrey Heteroscedasticity Test	1.148	0.447

Source: Author's computation using output from Eviews 11

Regarding whether the coefficients in the model are stable over time, the study relied on the Cumulative sum (CUSUM) and CUSUM of squares tests. As shown in Figure 1 and Figure 2, the model coefficients were found to be stable given that both the CUSUM and CUSM of squares are found within the critical band of the 5 percent significance level.

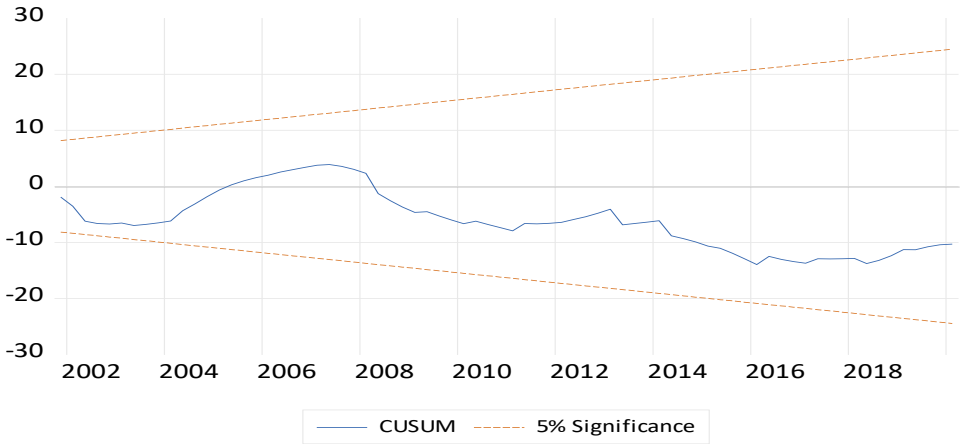

Figure 1: CUSUM Stability Test

Source: output from Eviews 11

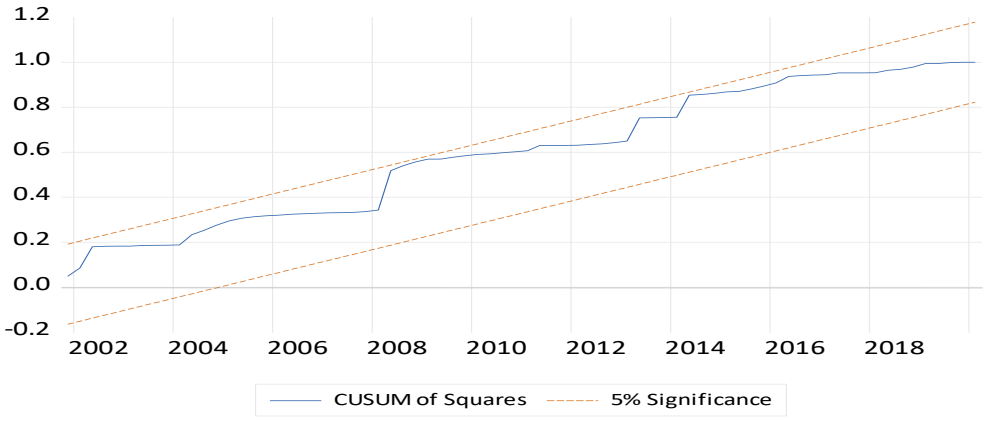

Figure 4.2: CUSUM Stability Test

Source: output from Eviews 11

6. Conclusion

This study focuses on the challenges faced by developing economies like Sierra Leone in achieving consistent and sustainable economic growth. The primary objectives are to investigate the effect of inflation and unemployment on economic growth in Sierra Leone and to explore the existence of a long-term relationship between these variables. The study utilizes quarterly time series data from 1991Q1 to 2020Q1 and employs the ARDL estimation technique for analysis. The findings revealed a significantly negative long-run effect of inflation, unemployment, and the war dummy variable on economic growth in Sierra Leone. However, the effect of trade openness on economic growth in the long run is found to be statistically insignificant, despite having the expected direction. For the short run, an ARDL model with a lag structure of (2, 2, 0, 1, 2) is utilized. The results indicate that the error correction term (ECT) is negative and statistically significant, reinforcing the presence of a long-term relationship. In the short run, variables such as the lagged value of economic growth, inflation, trade openness, and the war dummy variable have a significant impact on economic growth. In particular, inflation, the war

dummy variable, and trade openness exhibit a negative effect, while the lagged value of economic growth, inflation, and the war dummy variable show a positive impact.

Based on these findings, the study provides policy recommendations for Sierra Leone. It suggests that reducing inflation levels to single digits through credible inflation targeting processes or effective money supply control mechanisms can strengthen the macroeconomic position, boost investor confidence, and stimulate economic growth. Addressing unemployment requires creating opportunities to fully utilize the human resources, especially through providing relevant skills to the population, particularly the youth, to enhance productivity. Additionally, strengthening institutional quality, promoting national cohesion, and revising trade policies are recommended to mitigate the negative short-run effects of the war and trade openness on economic growth. But more so, this would be critical for ensuring sustained economic growth and development in Sierra Leone.

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