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Monetary Policy, Exchange Rate Fluctuations and Trade Balance: The Sierra Leone Experience

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Abstract

This study investigates the effect of monetary policy and exchange rate fluctuations on trade balance in Sierra Leone using the autoregressive distributed lag (ARDL) bound testing framework with annual times series data covering the period 1980 to 2020. The results from the unit root test reveal a combination of I(0) and I(1) series, while the bound test result confirms there is cointegration, which validates the existence of a long-run relationship. The long run results reveal that, money supply, real effective exchange rate and real GDP are the main determinants of trade balance in Sierra Leone. The findings indicate that money supply and real effective exchange rate have negative impact on trade balance, whilst a positive relationship exists between real GDP and trade balance. Furthermore, results from the beta coefficients confirm that real GDP has the greatest effect on trade balance in the long run, followed by real effective exchange rate, whilst money supply has the least effect. Also, the short run ARDL error correction model results reveal that real GDP, government expenditure and foreign direct investment are the main determinants of trade balance in Sierra Leone. The diagnostic result posits that about 85% of the variation in trade balance is explained by the independent variables, as evident by the R-square value of 0.85. The CUSUM and CUSUMSQ tests indicate that the model is stable. A major policy recommendation is to maintain exchange rate stability consistent with its equilibrium path, and ensure that money supply growth is in tandem with domestic demand for non-tradeable goods and services.

Keywords

Annual Data, ARDL, Sierra Leone, Trade Balance

1. Introduction

The trade balance is a major component of the balance of payment and a key indicator of a country's external competitiveness. The trade balance is the difference between the monetary value of a country's imports and exports over a given time period. The trade balance (TB) is also defined as the ratio of export value to import value. This definition of trade balance has been widely used and preferred in the literature, given that the ratio is insensitive to units of measurement and can be interpreted as nominal or real trade balance (see Bahmani-Oskooee, 1991; Hsing, 2005). A nation is said to have a favourable (surplus) balance of trade if the value of exports is greater than imports whereas an unfavourable (deficit) balance of trade occurs when the value of imports is higher than exports. The role of foreign trade is very crucial for the economic growth and development of a country. Foreign trade serves as an important conduit in boosting the economic and social performance of countries, especially developing countries. Furthermore, trade increases welfare by expanding market access; creates an ambiance for non-performing firms to be efficient and; helps countries in acquiring goods and services that are not available domestically or that are relatively cheaper in foreign countries. Thus, fluctuation in foreign trade is a major concern, especially for developing countries facing chronic trade deficits.

The literature suggests that most developing countries usually employ exchange rate devaluation/depreciation and monetary policy to improve their trade balance positions. Economic theory postulates that changing the nominal exchange rate can be used to improve trade balance position through changing the relative prices of exports and imports. Thus, the exchange rate is one of the most important policy variables, which determines the flow of trade, capital, and foreign direct investment, inflation, international reserves and remittance of an economy (Nusrate, 2008). Monetary policy, on the other hand, refers to the utilization of the central bank's monetary weapons to control and regulate the availability of credit in the economy in order to achieve the objectives of price stability, increased economic growth, and improvements in the balance of payments. The monetary policy in this regard is highly important since it maintains the internal targets of the economy as well as monitors the external balance. Therefore, monetary policy performs the dual goal of stabilizing interest rate (in order to maintain output and price level) and exchange rate (the aim is to maintain competitiveness in international trade). It is worthy to note that, over the years, the trade balance of most countries in sub-Saharan Africa (SSA) has been in deficit. Shawa and Shen (2013) postulate that the persistent trade deficit experienced by SSA countries is largely due to the formulation and adoption of poor economic strategies in key economic reform programmes; over-reliance on primary products for export; non-diversification of their economies and; high dependency on imported manufactured goods, among others.

The theoretical literature is largely dominated by three models that seek to explain fluctuations of a country's trade balance. These models include: the elastic-

ity approach, monetary approach and absorption approach. The elasticity approach posits that real devaluation or depreciation of domestic currency will improve the trade balance if the sum of the elasticities of demand for export and import is greater than one i.e. devaluation will improve the trade balance if the Marshal-Lerner condition is satisfied. This theoretical relationship suggests that the exchange rate depreciation can improve the trade balance in the long run, but it has to be adjusted through deterioration in the trade balance in the short run, a phenomenon dubbed the J-curve effect (Magee, 1973). The monetary approach on the other hand postulates that the balance of payments is always and everywhere a monetary phenomenon and explains its position by the interaction between the demand and supply of money. The monetarist view suggests that an excess demand (supply) for foreign goods would require more demand (supply) of the stock of money (Polak, 1957; Hahn, 1959; Johnson, 1972; Frenkel, 1976; Duasa, 2007). Thus, if the demand for money exceeds the money supply, then the excess demand for money will be satisfied by inflows of money from abroad, and this will improve the trade balance. Conversely, if the money supply is greater than the demand for money, the excess supply of money will be eliminated by outflows of money abroad and this will worsen the trade balance. The absorption approach suggests that a country's trade balance will improve if the total output exceeds total domestic spending. Therefore, currency devaluation will improve the trade balance only if the gap between domestic output and expenditure increases (Alexander, 1952; Harberger, 1950).

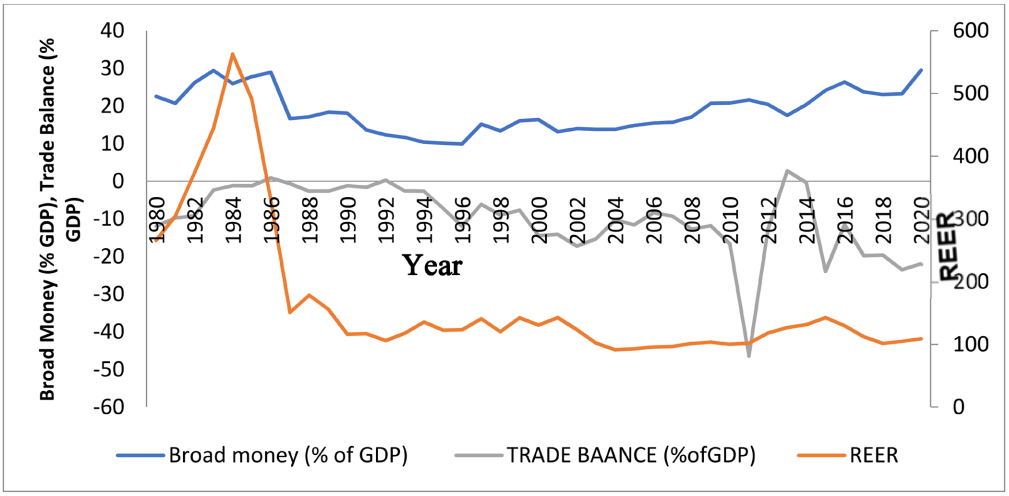
The empirical literature has produced mixed and inconclusive results on the effect of exchange rate and monetary policy on the trade balance. While a number of studies found that real exchange rate depreciation improves the trade balance (e.g., Baharumshah, 2001; Musila & Newark, 2003), many others reported a negative or insignificant relationship between the two variables (e.g. Bahmani-Oskooee, 1991; Rose, 1991; Rose & Yellen, 1989). Furthermore, some studies found a positive relationship between money supply and trade balance (Shah & Majeed, 2014), whilst others found a negative relationship (Duasa, 2007).

Since independence in 1961, the Sierra Leone economy has been plagued with chronic trade deficit, due to the imbalance in merchandise trade. The country's main imports are: machinery and transport equipment (50 percent of total imports), fuel (20 percent) and foodstuffs. Also, the main exports include: titanium ores and concentrates, rough wood, aluminum ores and concentrates, cocoa beans and unset diamonds, collectively accounting for 78.3% of total export. The country has also been typified by persistent exchange rate depreciation, excessive monetary and credit expansion, high inflation rate, deteriorating terms of trade, and large budget deficit. In the wake of the country's independence, the trade deficit amounted to $−8.9 million (2.71% of the country's GDP). Critical analysis of **Figure 1** suggests that, between 1980 and 2020, trade balance development indicates that Sierra Leone experienced only three years of trade surplus: 1986,

1992 and 2013. The trade surplus in 1986 was partly due to the implementation of the structural adjustment program (SAP), whilst the trade surplus in 2013 was on account of the iron ore boom and a surge in production in the agricultural sector. It is also evident from Figure 1, that the country recorded trade deficits for all other years (except 1986, 1992, 2013). The country recorded its worst trade deficit in 2011, reflecting high import of machinery prior to the commencement of iron ore mining in 2012. Also, the country registered a significant trade deficit in 2015 on account of the twin shocks including the fall in iron ore price and the outbreak of the Ebola disease. Also, the prevalence of the COVID-19 pandemic resulted in a large trade deficit in 2020, due to a slowdown in economic activity in the mining sector, especially iron ore. Analysis of Figure 1 also indicates that the money supply growth rate decelerated continuously between 1986 and 1996, which also corresponds to an improvement in the trade deficit. However, between 1997 and 2020, money supply growth increased, with an average growth rate of 20 percent. During this period, the trade deficit continues to worsen.

Also, Figure 1 reveals that the real effective exchange rate appreciated continuously during the early 1980s, attained its peak in 1984, which was in tandem with a sustained improvement in the trade deficit. However, between 1985 and 2020, the country witnessed continuous depreciation of the real effective exchange rate, a period that was also epitomized by a persistent trade deficit.

It is evident from the analysis that the relationship between money supply, real effective exchange rate, and trade balance in Sierra Leone did not exhibit any strong distinct pattern. Thus, it is, therefore, germane to conduct a study that seeks to establish the relationship between money supply, real effective exchange rate, and the trade balance in Sierra Leone. Against this background, the study investigates the effect of monetary policy and exchange rate fluctuations on the trade balance in Sierra Leone. The study utilizes the Autoregressive



Sources: World development indicator database 2021.

Figure 1. Trade balance, broad money and real effective exchange rate.

Distributed Lag (ARDL) modelling technique, with annual data for the period 1980 to 2020. In addition, the study performs the standardized beta coefficient test to compare the strength of money supply and real exchange rate as well as other control variables. Following this introduction, the rest of the paper is organized as follows: Section 2 discusses the relevant empirical literature. Section 3 presents the model specification and estimation techniques, while section 4 focuses on the discussion of empirical results. Section 5 concludes the study and proffers policy recommendations.

2. Literature Review

This section outlined a detailed literature survey on the impact of exchange rate and monetary policy on the trade balance. Empirically, studies have produced mixed results. For instance, Shah and Majeed (2014) investigate the long-run and short-run relationships between trade balance, income, money supply, and real effective exchange rate in Pakistan for the period 1980 to 2011. They used the ARDL bounds testing approach. The results show that an increase in the level of income and depreciation in the real effective exchange rate is negatively associated with the trade balance in the long run and short run. However, the results reveal that money supply determines the behaviour of the trade balance in the long run but not in the short run. Duasa (2007) examines the short-run and long-run relationships between trade balance, real exchange rates, income, and money supply in the case of Malaysia, using the ARDL approach and annual data from 1974 to 2003. The study finds evidence of a long-run relationship between trade balance and income and money supply variables but not between trade balance and real exchange rate. The findings also suggest that the Marshall-Lerner condition does not hold in the long run for Malaysia.

Mutana et al. (2018) investigate the macroeconomic determinants of trade balance in Kenya, from 1963 to 2016 using Vector Error Correction Model. The results show that terms of trade, trade liberalization, and FDI have a significant positive long-run relationship with trade balance. Furthermore, the findings reveal a negative and significant long-run relationship between real exchange rate and trade balance. Keho (2021) investigates the determinants of the trade balance in the West African Economic and Monetary Union (WAEMU) over the period 1975-2017. The study employs the Mean Group (MG), Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS) models. The results reveal that the trade balance is negatively related to domestic and foreign income and positively related to real effective exchange rate depreciation in the long-run. However, the results do not confirm evidence of the J-curve. Alhanom (2016) examines the determinants of the trade balance for Jordan, using annual data from 1970 to 2016 and applying the ARDL model and the Vector Autoregressive (VAR) model. The empirical result reveals that the real exchange rate is an insignificant determinant of trade balance both in the short and long run. The results also show that foreign income has a significant impact on the trade balance in the long run.

Rahmon and Adefunke (2016) empirically investigate the relationships among money supply, government revenue, government expenditure, domestic debt, external debt, inflation rate, exchange rate, and balance of trade in Nigeria, using time series data from 1981 to 2017 and employing the Johansen's methodology. The results indicate that government revenue, government expenditure, exchange rate, and inflation rate have statistically significant positive relationships with a balance of trade while money supply, domestic debt, and external debt exert a statistically significant negative impact on the balance of trade in Nigeria.

Mohammad (2010) examines the long-run as well as short-run determinants of trade balance in Pakistan using Johansen and Error correction Model (ECM) approach. The finding suggests that foreign income, foreign direct investment, domestic household consumption, and real effective exchange rate significantly affect the trade deficit. In a similar study, Nizamani et al. (2016) conduct a study to trace the effects of monetary policy and exchange rate on the trade balance of Pakistan, employing the Vector Error Correction Models (VECM) and using monthly data from 2003 to 2013. The results reveal that the monetary policy shocks improve the aggregate trade balance in the short run, but it sets negative effects on the trade surplus sectors. The results also show that exchange rate depreciation exerts negative effects on the trade balance for both aggregate and disaggregate levels. Guy Herve et al. (2010) investigate the effect of real exchange rate on the balance of trade in Cote d'Ivoire using multivariate cointegration tests and Vector Error Correction Models covering the period from 1975 to2007. The results demonstrate that the real exchange rate has a significant positive influence on Cote d'Ivoire's trade balance in both the short and long run. Eke et al. (2015) estimate the effect of the exchange rate on the balance of trade of Nigeria for the period 1970-2012 using Johansson techniques. The results show that the exchange rate has a significant negative influence on the trade balance in Nigeria during the period. Kim (2001) examines the effects of monetary policy shocks on the trade balance in small open European countries (Italy, France, and the UK) using VAR model and monthly data from 1976 to 1996. The results are consistent with the expenditure switching effect, but there is little evidence of the J-curve effect. Adhikari (2016) investigate the determinants of trade balance for the US and BRICS countries, using panel data from 1995 to 2014. Variables used include domestic (U.S.) and foreign real GDPs, exchange rate of U.S. dollar, and monetary policy (credit easing) dummy. The results find that the Fed's quantitative easing has no effect, whatsoever, on U.S. balance of trade.

Lucy et al. (2015) conduct a study to examine the relationship between Exchange Rate and Trade Balance in Ghana, testing the Validity of the Marshall Lerner Condition, using VECM and data from 1980 to 2013. The results show that exchange rate devaluation leads to a decline in the trade balance. Ray (2012) examines the short and long run determinants of the balance of trade in India using annual data from 1972 to 2011 and employing the VECM. The results suggest that consumption and real effective exchange rate have a negative impact

on the balance of trade in India. Nur (2016) investigates the determinants of Trade Balance in Somalia, employing Ordinary Least Square (OLS) technique with annual data from 1970 to 2010. The result suggests that the Foreign Direct Investment is the main determinant of Trade Balance during the study period. Bangura et al. (2013) examine the role of exchange rates in determining short- and long-run trade balance behaviour for Sierra Leone using annual data from 1980 and 2011, and employing the ARDL technique. The results reveal that domestic income and money supply are the main determinants of trade balance in Sierra Leone in the long run. Furthermore, the findings also suggest that Marshall-Lerner condition does not hold in the long-run for Sierra Leone. The short-run results reveal that real money supply and a one period lag of real exchange rate have a negative significant effect on trade balance.

The empirical literature has produced mixed and inconclusive results in explaining the impact of exchange rate and monetary policy on the trade balance. Some studies found a positive relationship between exchange rate and trade balance (Guy Herve et al., 2010; Rahmon & Adefunke, 2016), while others established a negative relationship (Ray, 2012). Also, few studies found no significant relationship between exchange rate and trade balance (Alhanom, 2016). Furthermore, some studies found a positive relationship between money supply and trade balance (Nizamani et al., 2016), but few studies established a negative relationship between these two variables (Rahmon & Adefunke, 2016). Based on the conflicting and inconclusive results on the impact of exchange rate and monetary policy on trade balance, this study seeks to contribute to the empirical debate by investigating the impact of exchange rate and monetary policy in Sierra Leone, a small open economy typified by chronic trade deficit, persistent depreciation of the exchange rate and rising growth rate of money supply. The study employs the ARDL estimation framework.

3. Model Specification

In line with theoretical and empirical framework for modelling the balance of trade equation, this study builds on the empirical work of Akorli (2017), and also takes into consideration the structure of the Sierra Leone economy, which is typified as an import dependent economy. The theoretical framework for this study is premised on a hybrid of both the elasticity and monetary approaches. The elastic approach suggests that exchange rate depreciation/devaluation will improve the trade balance if the sum of the elasticities of demand for export and import is greater than one. In other words, exchange rate depreciation will have a negative impact on the trade balance in the short run, but a positive impact in the long run. On the other hand, the monetary approach posits that the balance of payment is a monetary problem. Thus, the balance of payment position is explained by the interaction between the demand and supply of money, such that, an excess demand (supply) for foreign goods would require more demand (supply) of the stock of money. The study employs the Autoregressive distributed lag (ARDL) bound test-

ing approach, which is a dynamic heterogeneous model, that has the advantage of using both I(0) and I(1) variables, and is also used to establish the existence of cointegration among variables. The model for this study is specified as follows:

$$\begin{aligned}\log tb_t = {} & \beta_0 + \beta_1 \log ms_t + \beta_2 \log reer_t + \beta_3 \log rgdp_t + \beta_4 \log cpi_t \\ & + \beta_5 \log gov_t + \beta_6 \log\ fdi_t + \mu_t\end{aligned} \tag{1}$$

where *tb* is trade balance, ms is money supply, *reer* is real effective exchange rate, *rgdp* is real GDP, *cpi* is consumer price index (used to measure inflation), *gov* is government expenditure, *fdi* is foreign direct investment. The subscript t denotes the time dimension, β_0 is the intercept and $\beta_i \left(i = 1, 2, \cdots, 6\right)$ are the parameters to be estimated, and μ_t is the error term, which is assumed to be independently and identically distributed with zero mean and constant variance i.e. $\mu_t \approx iid\left(0, \sigma\right)$. All variables are expressed in the natural log, and their coefficients are interpreted as elasticities.

In order to conduct the bound test of cointegration, the study transformed Equation (1) into an unrestricted ARDL model, which is specified as follows:

$$\begin{aligned}\Delta \log tb_t = {} & \delta_0 + \sum_{i=1}^{p} \alpha_1 \Delta \log tb_{t-1} + \sum_{i=1}^{q} \alpha_2 \Delta \log ms_{t-1} + \sum_{i=1}^{q} \alpha_3 \Delta \log reer_{t-1} \\ & + \sum_{i=1}^{q} \alpha_4 \Delta \log rgdp_{t-1} + \sum_{i=1}^{q} \alpha_5 \Delta \log cpi_{t-1} + \sum_{i=1}^{q} \alpha_6 \Delta \log gov_{t-1} \\ & + \sum_{i=1}^{q} \alpha_7 \Delta \log\ fdi_{t-1} + \beta_1 \log tb_{t-1} + \beta_2 \log ms_{t-1} + \beta_3 \log reer_{t-1} \\ & + \beta_4 \log rgdp_{t-1} + \beta_5 \log cpi_{t-1} + \beta_6 \log gov_{t-1} + \beta_7 \log\ fdi_{t-1} + \mu_t\end{aligned} \tag{2}$$

Where Δ is the difference operator, p and q are the maximum lag for the dependent and independent variables, respectively, the $\alpha_i \left(i = 1, 2, \cdots, 7\right)$ represent the short-run coefficients, $\beta_i \left(i = 1, 2, \cdots, 7\right)$ are the long-run coefficients, μ is the error term, all other variables are as defined earlier. To conduct cointegration within the bound testing approach, we test the long-run coefficients by specifying the null hypothesis of no cointegration, against the alternative hypothesis of cointegration. Thus, the hypotheses are specified in the form:

$$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$$

$$H_0 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$$

Based on the specification of the null and alternative hypotheses, we compute the F-statistics. The conditionality is that, if the F-statistics is greater than the upper bound statistics, we conclude that there is cointegration, i.e. there is a long run relationship. On the other hand, if the F-statistics is below the lower critical value, we conclude there is no cointegration, i.e. there is no long run relationship.

Thus, if there is cointegration, then the study proceeds to re-specify Equation (2) into an error correction model, given as follows:

$$\begin{aligned}\Delta \log tb_t = {} & \delta_0 + \sum_{i=1}^{p} \alpha_1 \Delta \log tb_{t-1} + \sum_{i=1}^{q} \alpha_2 \Delta \log ms_{t-1} + \sum_{i=1}^{q} \alpha_3 \Delta \log reer_{t-1} \\ & + \sum_{i=1}^{q} \alpha_4 \Delta \log rgdp_{t-1} + \sum_{i=1}^{q} \alpha_5 \Delta \log cpi_{t-1} + \sum_{i=1}^{q} \alpha_6 \Delta \log gov_{t-1} \\ & + \sum_{i=1}^{q} \alpha_7 \Delta \log\ fdi_{t-1} + \delta ect_{t-1} + \mu_t\end{aligned} \tag{3}$$

where the coefficient δ measures the speed of adjustment between the short-run and long-run disequilibrium, and ect_{t-1} is the Error Correction Term is

represented as independent variable in the estimation process, and covers all the long-run information that was lost in the original estimation process. Equation (3) can also be expressed as follows:

$$\begin{aligned}\Delta \log tb_t = {} & \delta_0 + \sum_{i=1}^{p} \alpha_1 \Delta \log tb_{t-1} + \sum_{i=1}^{q} \alpha_2 \Delta \log ms_{t-1} + \sum_{i=1}^{q} \alpha_3 \Delta \log reer_{t-1} \\ & + \sum_{i=1}^{q} \alpha_4 \Delta \log rgdp_{t-1} + \sum_{i=1}^{q} \alpha_5 \Delta \log cpi_{t-1} + \sum_{i=1}^{q} \alpha_6 \Delta \log gov_{t-1} \\ & + \sum_{i=1}^{q} \alpha_7 \Delta \log\ fdi_{t-1} + \delta \left[\log tb_t - \beta_0 - \beta_1 \log ms_t - \beta_2 \log reer_t \right. \\ & \left. - \beta_3 \log rgdp_t - \beta_4 \log cpi_t - \beta_5 \log gov_t - \beta_6 \log\ fdi_t \right] + \mu_t \end{aligned} \tag{4}$$

Note that, all coefficients of the short-run equation are coefficients relating to the short-run dynamics of the model's convergence to equilibrium and δ represents the speed of adjustment.

The equation for the error correction term is derived from Equation (3), and is given as follows:

$$\begin{aligned} ect_{t-1} = {} & \Delta \log tb_t - \delta_0 - \sum_{i=1}^{p} \alpha_1 \Delta \log tb_{t-1} - \sum_{i=1}^{q} \alpha_2 \Delta \log ms_{t-1} \\ & - \sum_{i=1}^{q} \alpha_3 \Delta \log reer_{t-1} - \sum_{i=1}^{q} \alpha_4 \Delta \log rgdp_{t-1} - \sum_{i=1}^{q} \alpha_5 \Delta \log cpi_{t-1} \\ & - \sum_{i=1}^{q} \alpha_6 \Delta \log gov_{t-1} - \sum_{i=1}^{q} \alpha_7 \Delta \log\ fdi_{t-1} \end{aligned} \tag{5}$$

Both the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) were used to test for the stability of the model. The rule of thumb is that, If CUSUM and CUSUMSQ lies within the acceptable confidence interval, we conclude that the regression model is stable. Annual time series data for the period 1980 to 2020 were used in the study. Data were obtained from the Bank of Sierra Leone database and the International Financial Statistics Yearbook of the IMF.

4. Analysis of Result

4.1. Unit Root Result

Stationarity test was performed on the variables of interest using the Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) tests, in order to establish the level of integration of the variables. The study conducts unit root test on all the variables in levels. The results in Table 1 confirm that only cpi and fdi are stationary in levels. Thus, cpi and fdi are integrated of order zero, i.e. they are I(0) series. However, when other variables were differenced once and subjected to unit root test, they became stationary. The results suggest that, tb, ms, reer and gov were non-stationary in levels, but became stationary at first difference, which indicates that these variables are integrated of order one, i.e. I(1) series. The unit root results confirm that the variables are integrated of mixed order, i.e. I(0) and I(1) series, which validates the use of the ARDL methodology.

4.2. Selection of Optimal Lag Length

A pre-condition for the bound test for cointegration is to determine the optimal

Table 1. Result of Unit root test.

Variables	Augmented Dickey-Fuller (ADF)		Phillip-Perron (PP)		Order of Integration
	Levels	First difference	Levels	First difference	
log *tb*	−1.9965	−6.0848*	−2.1161	−6.0844*	I(1)
log *ms*	−1.3625	−6.4027*	−1.3304	−6.4272*	I(1)
log *reer*	−1.5693	−4.9214*	−1.8723	−4.8600*	I(1)
log *rgdp*	−1.9213*	−3.8373**	−1.1624	−3.6623**	I(1)
log *cpi*	−3.2710		−4.2312		I(0)
log *gov*	−3.2014	−8.2428*	−3.0992	−9.2913*	I(1)
log *fdi*	−4.4819*	–	−6.5546*	–	1(0)

Note * and ** indicates stationarity at 1% and 5% level of significance, respectively. Source: Authors computation

Table 2. Result of optimal lag.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−138.522	NA	4.11e−06	7.46270	7.7612	7.56980
1	134.7893	434.4949	4.32e−11	−4.04048	−1.65177*	−3.18343*
2	190.7662	68.8947*	3.88e−11*	−4.39827*	0.08055	−2.79131

Source: Authors computation.

lag structure of the model. The study utilizes five optimal lag selection criteria: Likelihood Radio (LR); Final Prediction Error (FPE); Akaike Information Criterion (AIC); Schwarz Information Criterion (SC); and Hanna-Quinn Information Criterion (HQ). The result of the optimal lag length is presented in Table 2. The result confirms a lag length of 2, as the optimal lag for the model.

4.3. Bound Test for Cointegration

Given that some of the variables were differenced once to ensure stationarity, the study therefore proceeds to perform a bound test for co-integration to ascertain whether there is a long run relationship amongst the variables. The intuition behind the bound test is that, if the F-statistics is greater than the upper bound value at the 1% or 5%, then we reject the null hypothesis of no co-integration, and infer the presence of cointegration, denoting the existence of a long run relationship. However, if the F-statistics is less than the lower bound value, then we accept the null hypothesis, and conclude there is no cointegration. The result of the bound test as given in Table 3, indicates that the F-statistics of 6.464 is greater than the upper bound values at both the 1% and 5%, hence the study confirms the existence of cointegration, indicating there is a long run relationship among the variables included in the study.

Table 3. Bound test result.

Test Statistics	Value	Significance	I(0)	I(1)
F-statistics	6.464	10%	1.99	2.94
K	6	5%	2.27	3.28
		1%	3.02	4.51
Asymptotic: n = 1000				

Source: Authors computation.

Table 4. ARDL Long run results.

Variables	Coefficients	Std. Error	t-Statistics	Prob.
log *ms*	−0.7231	0.3358	−2.1535	0.0379
log *reer*	−0.9209	0.3021	−3.0483	0.0121
log *rgdp*	0.8954	0.4019	2.2279	0.0299
log *cpi*	1.2109	0.8828	1.0690	0.2532
log *gov*	0.7635	0.7288	1.0476	0.2723
log *fdi*	0.4281	0.4522	0.9468	0.3673
C	−21.7452	4.7432	−4.5845	0.0001

Source: Authors computation

4.4. ARDL Long Run Analysis

Once a long run relationship has been established based on the cointegration results, the study proceeds to estimate the long run equation. The result is presented in Table 4. The long run result shows that money supply, real effective exchange rate and real GDP are the main variables influencing trade balance with statistically significant coefficients. The findings establish a negative relationship between money supply and trade balance, a result that is consistent with the monetary view. The result indicates that an increase in money supply by 1% will deteriorate the country's trade balance by approximately 0.72%. Intuitively, an increase in money supply will result to an increase in the demand for imported goods through the income absorption effect, which therefore lead to an increase in import, hence a deterioration of the trade balance. This finding is consistent with the empirical works of Rahmon and Adefunke (2016), Bangura et al. (2013).

The findings further reveal that an increase in the real effective exchange rate (indicating an appreciation) by 1%, will worsen the trade balance by approximately 0.92%. Intuitively, an appreciation of the exchange rate, will increase domestic demand for imports and a fall in foreign demand for export, leading to a deterioration of the trade balance. This result bodes well with the findings of Eke et al. (2015), Nizamani et al. (2016). The result also reveals that RGDP positively affects trade balance in Sierra Leone in the long run, a result consistent

with the absorption approach, An increase in real GDP by 1% results in an improvement in the country's trade balance by 0.90%. The rationale behind such a result is premised on the fact that, an increase in. real GDP will trigger an increase in export with a positive effect on the trade balance. A similar result was obtained by Duasa (2007), Kakar et al. (2010).

4.5. Comparison of Beta Coefficients

The study performs the beta coefficient in order to compare the strength of the independent variables in influencing the trade balance. Beta coefficient (β) of a variable is defined as follows: $\beta = b\left(\frac{se}{SE}\right)$, where b = coefficient of the variable, se = standard error of the variable, and SE = standard error of the regression. A higher beta coefficient implies stronger influence of that variable on the dependent variable and a lower beta coefficient denote a weak influence of the variable on the dependent variable. The result of the beta coefficients is presented in Table 5. Comparison of the beta coefficients of the independent variables, as shown in Table 5, reveals that real GDP has the greatest effect on trade balance in the long run, followed by real effective exchange rate, whilst money supply has the least effect.

4.6. Short Run ARDL Analysis

The short-run ARDL Error Correction Model result is presented in Table 6. The result confirms that real GDP, government expenditure and FDI are the main variables influencing trade balance in the short run, with statistically significant variables. The short run result bodes well with the long-run analysis, suggesting a positive relationship between real GDP and trade balance. The result also establishes a positive relationship between government expenditure and trade balance. The findings show that a 1% increase in government expenditure, will improve the trade balance by 0.8%. Intuitively, an increase in government expenditure on productive areas like infrastructure, health, agriculture and education helps boost domestic production which translates into export expansion and improvement in the country's trade balance. However, the result confirms a negative relationship between FDI and trade balance. The result suggests that a 1% increase in FDI will lead to a worsening of the trade balance by approximately 0.29%. Similar result was obtained by Nur (2016).

Table 5. Beta Coefficient results.

Variable	Beta Coefficient	Rank
Money supply (ms)	0.6815	3rd
Real effective exchange rate (reer)	0.788	2nd
Real GDP (rgdp)	1.010	1st

Source: Authors computation.

Table 6. Short run ARDL-ECM (1, 0, 0, 2, 0, 2, 2).

Variable	Coefficient	Std. Error	t-Statistics	Prob
D (log *rgdp*)	1.036866	0.300463	3.450895	0.0020
D (log *rgdp* (−1))	−0.909687	0.286929	−3.170423	0.0040
D (log *gov*)	0.273439	0.278641	0.981329	0.3358
D (log *gov* (−1))	0.822420	0.243773	3.373718	0.0024
D (log *fdi*)	−0.299062	0.090183	−3.316158	0.0028
D (log *fdi* (−1))	−0.398686	0.092992	−4.287294	0.0002
ECT (−1)	−0.687057	0.123841	−5.547882	0.0000

R-square	0.8453	Mean dependence var	−0.8247
Adjusted R-square	0.7648	S.D. dependence var	0.7347
S.E. of Regression	0.3563	kaike info criterion	1.0474
Sum squared resid	3.1745	Schwarz criterion	1.6446
Log likelihood	−6.4247	Hannan−Quinn criter.	1.2617
F-statistics	10.5043	Durbin−Watson stat	1.7762
Prob(F-statistics)	0.00000		

Source: Authors computation.

The result also reveals that the coefficient of the error correction term (ECT) has the expected sign and is statistically significant. Thus, with an ECT of −0.687, the result indicates that any disequilibrium in the trade balance is corrected for at 69% speed of adjustment within one year, indicating a high speed of adjustment to long run equilibrium.

4.7. Stability Test

The study performs the stability test in order to validate the structural stability of the regression coefficients. The study employs two tests: the cumulative sum recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests as shown in Figure 2 & Figure 3, respectively. Results from the CUSUM and CUSUMSQ confirm that the model is stable, since both test statistics lies within the 5% critical bound.

5. Conclusion

The focus of this study was to investigate the effect of monetary policy and exchange rate fluctuations on trade balance in Sierra Leone. The study utilized annual data spanning from 1980 to 2020 within the ARDL framework. The study also employed the beta coefficient to compare the strength of the independent variables on the trade balance. The unit root test results established a mixture of I(0) and I(1) series, which validate the use of the ARDL bound testing approach. Results from the bound test confirmed cointegration, denoting the existence of a long-run relationship. The long-run results revealed that money supply, real

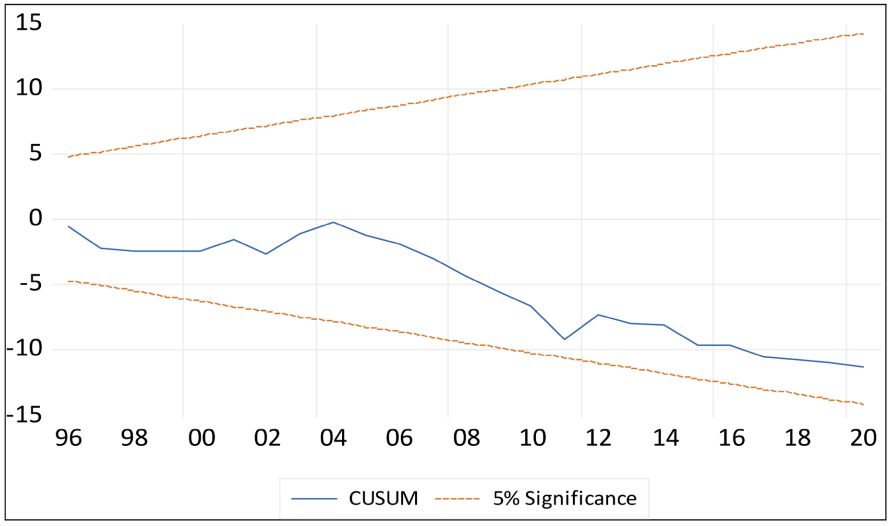


Figure 2. CUSUM test for stability.

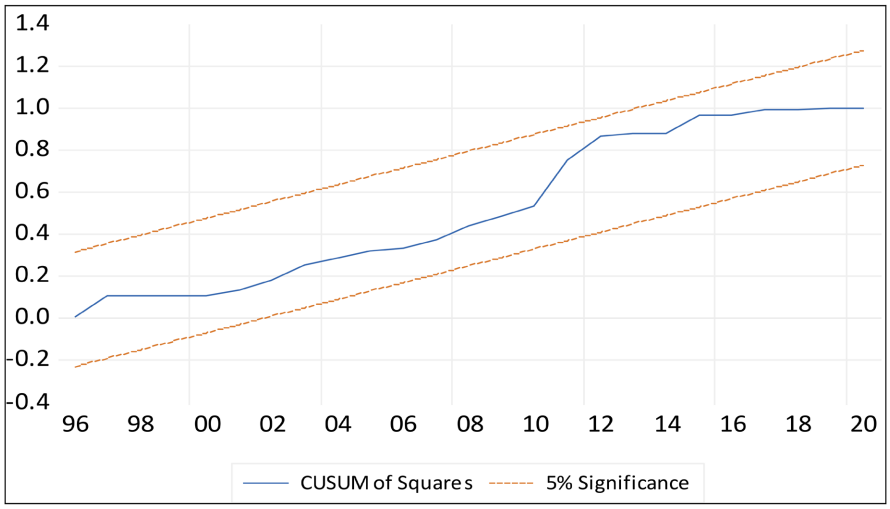


Figure 3. Plot of CUSUM sum of squares test.

effective exchange rate and real GDP were the main determinants of trade balance in Sierra Leone. The findings showed that money supply and the real effective exchange rate had a negative impact on the trade balance, whilst a positive relationship was established between real GDP and trade balance. Furthermore, results from the beta coefficients showed that real GDP had the greatest effect on the trade balance, in the long run, followed by a real effective exchange rate, whilst money supply had the least effect. Also, the results revealed that real GDP, government expenditure, and foreign direct investment were the main determinants of trade balance in the short run.

With an error correction term of −0.687, the result showed that approximately any movement into disequilibrium in the trade balance is corrected at 69% adjustment speed within one year, indicating a high speed of adjustment to long-run equilibrium. Results from the CUSUM and CUSUMSQ confirmed that the model is stable since both test statistics lie within the 5% critical bound. The

diagnostic test revealed that about 85% of the variation in the trade balance is explained by the independent variables. A major policy recommendation of the study is the need for the monetary authority to pursue prudent monetary policy consistent with domestic absorption, such that money supply growth should be in tandem with domestic demand for non-tradeable goods and services. This will mitigate the issue of expenditure switching in favour of tradeable goods. The government is also encouraged to maintain a more competitive exchange rate devoid of excessive fluctuation. Establishing an exchange rate consistent with its long-run equilibrium exchange rate, will enhance the international competitiveness of the domestic economy, hence improving the trade balance.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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