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The effect of real exchange rate on trade balance: Econometric evidence from Sierra Leone

Daniel Kassim Sesay^{1*}, Ibrahim Mansaray², Caroline J Bah³

¹ Lecturer, Department of Economics, Faculty of Social Sciences, Ernest Bai Koroma University of Science and Technology, Sierra Leone

² Lecturer, Department of Social Work, Faculty of Social Sciences, Ernest Bai Koroma University of Science and Technology, Sierra Leone

³ Lecturer, Department of Accounting and Finance, Faculty of Social Sciences, Ernest Bai Koroma University of Science and Technology, Sierra Leone

Corresponding Author: **Daniel Kassim Sesay**

Abstract

Whether exchange rate devaluation improves or worsens the trade balance has been an interesting and important area of research for economists and policymakers. This study attempts to identify the effect of real exchange rate on the trade balance of Sierra Leone from 1980 to 2017. A model of trade balance was estimated by first examining the time series properties and estimating an ARDL model in the context of the Pesaran-Pesaran method of bounds testing for cointegration. The explanatory variables used are: real exchange rate, real gross domestic product growth, absorption, export, import, real effective exchange rate volatility, rate of absorption and foreign income. The main finding is that there is a long run relationship between trade balance and the model variables, with a positive effect of real exchange rate on the trade balance. On the other hand, real

effective exchange rate was found to have a negative effect on the trade balance. However, real exchange rate volatility was found to have no impact on the trade balance in both the short and long run.

Based on the empirical findings therefore, policymakers should adopt measures to boost local productivity, which include measures to boost competitiveness through export substitution models, creation of economic zones, and increased subsidies for local industries. These include continued efforts to abate inflation from the monetary policy direction and from the direction of structural policies, including the need to boost agricultural output in order to stabilise the nominal exchange rate by reducing imports of goods that can be produced home.

Keywords: Real Gross Domestic Product Growth, Absorption, Export, Import, Real Effective Exchange Rate Volatility, Rate of Absorption and Foreign Income

1. Introduction

There is widespread discussion among trade economists and policymakers over the high degree of exchange rate changes and its impact on trade balance in almost all economies. An exchange rate change is a numerical measure of the tendency for the exchange rate to rise or fall sharply within a short period and is important in understanding foreign exchange market behaviour. Whenever there is an exchange rate change, it creates uncertainty in macroeconomic policy formulation, foreign trade flows and investment decisions. The impact of exchange rate changes on trade balance has been studied in a large number of theoretical and empirical publications.

A rise in exchange rate risk has a Substitution Effect and an Income Effect. The substitution effect opts traders to substitute away from foreign trade towards domestic trade. It is believed that a rise in exchange rate changes increase the uncertainty of profits on contracts denominated in a foreign currency because this risk leads risk-averse and risk-neutral agents to redirect their activity from higher risk foreign markets to the lower risk home markets – (See for example Abu Bakarr Tarawalie & Christian Regobeth K. Ahortor (2012) ^[2]).

Also, the income effect leads to increase trade activity, since higher exchange rate changes and hence higher risk represents greater opportunity for profit and might increase trade flows.

Just as many developing countries, Sierra Leone depends on the rest of the world and the level of interdependence has increased in the last decades. Sierra Leone is vulnerable to any adverse changes in other economies and changes over which it do not exercise any control. Sierra Leone has increasingly liberalized its trade frontiers leading to lower barriers to trade, for both goods

goods and services. This has increased trade and intensified international competition.

Exchange rate changes may have important effects on trade flows, on direct investments, on output and on other variables.

An overvaluation of the exchange rate should lead to deterioration of the economic situation.

An overvalued currency brings about resource shift in favour of the non-tradable sectors, which reduces growth.

Again, an undervaluation of the exchange rate should lead to an improvement in economic performance.

Sierra Leone as a country considers exchange rate as a key macroeconomic policy instrument that enhances the country's competitiveness as well as export promotion, economic growth and its trade balance.

Just as the Central Bank of any country, the Bank of Sierra Leone (BSL) is responsible for the monetary policy of the country. Its exchange rate policy aims at providing an environment that promotes exchange rate stability and assists the government's objective of accomplishing export led growth. Its trade policies adoption ensured growth in exports which automatically lead to long term economic growth. The increased liberalization of trade and foreign exchange controls, exports promotion policies and multilateral trade agreements have led to greater penetration of Sierra Leone exporters to the international markets.

Increasing exchange rate changes, which is a major source of exchange rate risks, has significant and negative implications for the volume of trade flows and a country's Balance of Payments (Walters and De Beer 1999; Bah and Amusa, 2003; Vergil, 2002) ^[59, 14, 58].

Also, some studies provide evidence supporting a positive relationship between exchange rate changes and trade flows (see, for example, De Grauwe, 1988; Asseery and Peel, 1991; Chowdhury, 1993; among others) ^[26, 12, 23].

De Grauwe (1988) ^[26] for instance argues that if exporters are sufficiently risk-averse, then an increase in exchange rate changes results in an increase in expected Marginal Utility of export revenue that serves as an incentive to exporters to increase their exports in order to maximize their revenues and the trade balance of economies. This lack of consensus amongst policy makers is reflected in the different exchange rate regimes that countries have pursued over time.

After the collapse of the Bretton Woods System¹, a major concern of policymakers is the consensus of exchange rate changes which is a prominent feature of the floating exchange rate. Firms add risk premium to the cost of traded goods leading to higher prices and lower external trade due to exchange rate volatility. This has important implications for trade balance and growth prospects of countries.

1.2 The Problem

A major concern of economists and policymakers following the collapse of the Bretton Woods System is the consensus of exchange rate changes, which is a prominent feature of the floating exchange rate. Exchange rate changes make firms to add risk premium to the cost traded goods leading to higher prices and lower external trade. This has important implications for trade and growth prospects of the country.

Sierra Leone has been experiencing trade deficits for years back. One main reason for such performance is the economy's poor integration and the often exportation of certain primary products and importation of a lot of manufactured goods and hence a huge trade deficits are recorded.

Trade theory asserts that devaluation of currency plays a key role in improving trade balance of a country, but empirical findings showed misleading result.

Exchange rate in Sierra Leone has been changing since the adoption of the flexible exchange rate. These frequent changes in the exchange rate also influenced exports and trade balance to change. But the perceived correspondence between exchange rate changes and trade balance of Sierra Leone brought about some arguments.

Most African countries adopted economic reform programmes in the 1980s with exchange rate liberalization as a major component.

Exchange rate in Sierra Leone has been volatile since the adoption of the flexible exchange rate.

Sierra Leone's exports have been increasing after the United Nations' sanctions were lifted in 2010. The country's main exports are diamonds, cocoa and coffee, and its main export partners are: Belgium, Netherlands, China and United States. Exports represent an estimated 4.4% of total Sierra Leonean economic output. The republic of Sierra Leone shipped \$465.6 million worth of goods around the globe in 2016. That dollar amount results from a 66.7% gain since 2014 and a 399.3% uptick from 2015 to 2016.

From a continental perspective, \$168.5 million or 36.2% of Sierra Leonean exports by value were delivered to other African countries, while almost a third (31%) were sold to North American importers. Sierra Leone shipped another 24.6% worth of goods to buyers in Asia.

Given, Sierra Leone's population of 6 million people, its total \$465.6 million in 2016 exports translate to roughly \$80 for every resident in the country.

1.3 Research Questions

The research questions that guide this research work are as follow:

1. Is there any relationship between exchange rate changes and trade balance?
2. How significant is the effect of exchange rate changes on the trade balance of Sierra Leone?
3. What is the elasticity of trade balance with respect to real exchange rate changes?

1.4 Objectives of the Study

The overall objective of the study is to investigate the effect of real exchange rate on trade balance of Sierra Leone.

The specific objectives are:

1. To investigate the effect of real exchange rate on trade balance in the short run.
2. To investigate the effect of real exchange rate on trade balance in the long run
3. To investigate the elasticity of trade balance with respect to real exchange rate.

¹ The **Bretton Woods System** is a set of unified rules and policies that provided the framework necessary to create fixed international currency

exchange rates. Essentially, the agreement called for the newly created IMF to determine the fixed rate of exchange for currencies around the world

1.5 Exchange Rate Policy in Sierra Leone

In 1967, the Leone (Le), which is Sierra Leone's currency, was first devalued following the devaluation of the Pounds Sterling. The devaluation was done in order to prevent capital outflow following the devaluation of the pound sterling. In 1967, the Le was pegged to the British Pound and set at a rate of two Leones per British Pound.

The declining economic performance of the early 1980, including poor external sector performance, a dual exchange rate system was introduced in the late 1982, under the Modified Exchange Rate Arrangement (MERA). Here, both official exchange rate and commercial market rate were adopted. While the official exchange rate was set at Le 1.52 per US\$, the commercial market had no definite rate. Since external sector performance continued to deteriorate, this policy did not prove to be effective. The policy was not effective because people normally prefer the parallel market to the official market.

In 1990, Sierra Leone practiced a floating exchange rate, and most current account transactions were liberalized. The key motive behind this floating exchange rate was that, in the fixed exchange rate regime, the premium between the official and the parallel market rates was getting larger.

Smuggling of valued products like diamond, gold, and the like was considered to be on the increase, which undermined the BOP. Since the adoption of the floating exchange rate, the nominal exchange rate has been depreciating.

The black market premium further decreased in post-war period of the floating exchange rate regime. This implies that, though the floating exchange rate regime in Sierra Leone was of the managed type, the degree of overvaluation of the Leone decreased to a larger extent with the adoption of the regime and was further decreased by more than half in the post war period of the managed floating exchange rate regime.

As in the case of many developing countries, Sierra Leone continued the use of the fixed exchange rate regime after the collapse of the Bretton Woods System in the early 1970s.

However, with the experience of persistent deficit in the balance of payments, series of exchange rate adjustments were adopted in the 1980s. In 1986, Sierra Leone adopted a floating exchange rate system following the introduction of the Structural Adjustment Programme (SAP)². During this period, the government revalued the Leone from Le53=\$1 to Le23=\$1. The adoption of the floating exchange rate was aimed at increasing the competitiveness of the country's export, while maintaining a stable exchange rate with minimal volatility. In April 1991, a managed float was introduced as the previous fixed regime resulted in overvaluation of the currency. Under the managed float, the exchange rate was determined by market forces with periodic intervention by the Bank of Sierra Leone. This is being done through a weekly foreign exchange auction by the central bank.

Despite the numerous challenges facing Sierra Leone, recent economic growth has been a bit strong. After the post-war calamity, economic growth has been sustained at an annual average of 7.6% from 2003 to 2007, which is the best performance since 1980. The agricultural and mining sectors reactivation has been of support to this recovery.

Sierra Leone's economy is strongly reliant on the agricultural

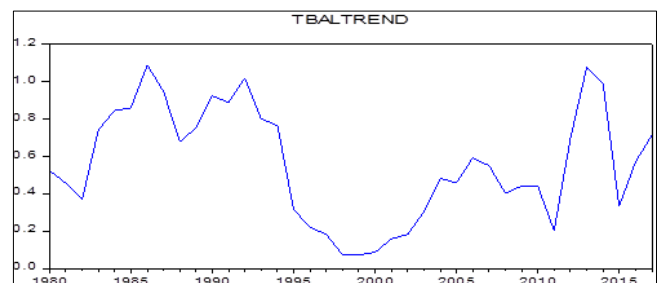
sector as it contributed 47.9 percent to GDP in 2014. It is also one of the largest sources of job creation employing 68.5 percent in 2014. With an estimated 5.4 million hectare of arable land, abundant farmland, varied ecosystem, fertile soil, and sufficient rainfall is a mainstay to agricultural success over the years. The government is investing heavily in this sector by improving transport to ease the movement of goods, encouraging and supporting private sector investment, as well as lending support to farmers. With declining international commodity prices, especially in iron ore which was one of the country's main export, agriculture is one of the diversified sectors the government is focusing its growth potential.

The sector is dominated by smallholder farmers, in subsistence farming, using traditional methods and limited use of farming inputs. There are fairly large agricultural estates, both government and privately owned. The current performance of agriculture represents a fraction of the underlying potential of the country.

In general, the country has made an effort to maintaining a stable macroeconomic environment which seems crucial.

As inflation and unemployment are termed the 'twin maladies' in economics, they are always issues of concern in Sierra Leone just as in any economy. For example, inflation skyrocketed as high as 14.4% in 2004. Policies were introduced by government to reducing inflation, and it later dropped to 9.5% by 2006. But this decline did not continue as we later saw inflation reached at 11.6% in 2008 reflecting external shocks affecting the prices of food items and fuel.

The nominal exchange rate depreciated drastically in 2006 and 2007 to control the rapid rise in inflation, keeping the real exchange rate stable, despite the deterioration of the terms of trade.



Source: Authors' Construct

Fig 1: Trend of real exchange rate of Sierra Leone

The figure shows the trend of trade balance of Sierra Leone from 1980 to 2017. Between 1980 and 1982, the country experienced adverse trade balance of 0.52 and 0.37 respectively. This could be attributed to excessive government expenditure, poor macroeconomic performance, budget deficit among others. Between 1982 and 1986, the country experienced dramatic improvement in the trade balance as net export averaged 0.37 to 1.09 which is recorded as the all-time high level of the trade balance. Some of the possible explanations for this are trade liberalization and adoption of Structural Adjustment Programmes. By contrast, the dramatic gains that began in 1982 and climaxed in 1986 were sharply eroded over the next couple of years to 0.68 in 1988. This decline could partly be explained to worsening

crises. The purpose is to adjust the country's economic structure, improve international competitiveness, and restore its balance of payments.

² Structural adjustment programs (SAPs) consist of **loans** (structural adjustment loans; SALs) provided by the International Monetary Fund (IMF) and the World Bank (WB) to countries that experienced economic

trade balance conditions with one of our largest trading partners in the Mano River Union (Liberia) that was engulfed by civil conflict. However, the trade balance increased sharply from the decline in 1988 to as high as 1.02 in 1992. Regardless of this sharp rise in the trade balance, the country recorded its ever lowest level of trade balance in 1999 which averaged to 0.07. This is due to the civil war faced by the country, which drove off many investors, closed down major businesses, created political instability, discouraged exports among other reasons. Immediately after the civil war, the country gradually improves on its trade balance which again rose to 0.59 in 2006. This sudden rise is captured by the conducive political climate faced by the country just after the war, which attracted most investors. The trade balance thereafter deteriorated to 0.20 in 2011 but again quickly skyrocketed to 1.08 in 2013. This is better explained by the high price of the nation's most exported product (iron ore) in the world market during those years. Between 2013 to 2015, the trade balance was again recorded at declining points from 1.08 in 2013 to 0.33 in 2015. This is evident from the Ebola Virus Disease and the Flooding that the country experienced during those periods. But from 2015 to date, the country is recovering and recording a moderate level of its trade balance.

1.6 Justification of the Study

Policymakers would need this research as a guide when it comes to implementing policies related to real exchange rate and trade balance of the country. The study is useful in this respect.

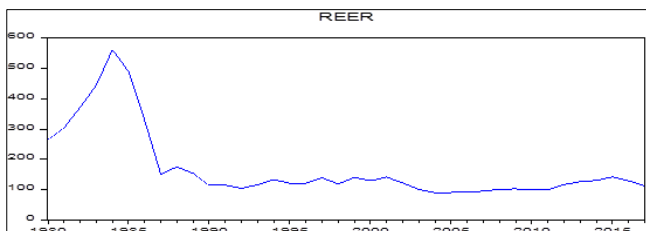
Furthermore, this research would meaningfully add to the educational materials already available in libraries and subsequent researchers interested in similar discipline would use it as reference material.

Sierra Leone economy has not been performing well in its balance of payments and other key macroeconomic determinants.

The country has long been recording persistent trade deficits and it is still the case even in recent years.

The balance of payment deficits, high inflationary and unemployment rates, unfavourable terms of trade, unfavourable exchange rate and high accumulation of public debt have always been the country's deterrents to growth and development.

Policy makers could better control imports and exports in a favourable direction so as to foster economic growth and development.



Source: Authors' Construct

Fig 2: Trend of trade balance of sierra leone

The above figure depicts the trend of the real effective exchange rate of Sierra Leone between 1980 to 2017. As could be observed from the figure, the real exchange rate shows massive fluctuations over the 37 years period. Specifically, in 1980, the real exchange rate stood at Le 265 to the U.S. Dollar. Between 1980 and 1984, the real exchange rate rose dramatically reaching an all-time high of Le 560 to the U.S. Dollar. This is attributed to excess demand for foreign currency coupled with low volume of export. However, over the next couple of years, we saw a massive decline in the real exchange rate during 1985 to 1987. In 1987, the real exchange rate stood at Le 150 to the U.S. Dollar. One of the major reasons for this improvement in the exchange rate was the implementation of the Structural Adjustment Programmes (SAPs) pioneered by the World Bank and I.M.F. These SAPs emphasized the promotion of exports and curtailing of excessive government expenditure on non-productive projects.

Consequently, external sector performance was reflected by an improvement in the real exchange rate over the given period. The remarkable performance of the Leone relative to the U.S. Dollar in the previous decades (1987-2000) grew even better after the war ended in 2000. Between 2000 and 2010, the real exchange rate averaged Le 121 to the U.S. Dollar. The major explanations in the improvement of the real exchange rate following the end of the war are the increase in Foreign Direct Investment inflows, political stability, improved business confidence and rebound export sector, among others

The situation in the next five years (2010-2015) was however least encouraging as the real exchange rate showed sharp increase from Le 100 to Le 143. This decline was due to the twin disasters (Ebola Virus Disease and Flooding decline in world commodity prices especially for Iron Ore) which crippled the economy in 2014 as major economic activities were halted. Interestingly, with the return to normalcy in economic activities in Sierra Leone when the Ebola Virus Disease was declared over, the real exchange rate showed steep decline from Le 143 in 2015 to Le 112 in 2017.

1.6 Scope of the Study

This research is carried out on a small but open and developing country, Sierra Leone. The country is selected for this study because of the poor economic performance being experienced over the years in both internal and external sectors ranging from high inflationary rates, persistent balance of payments problems and low economic growth.

The study period covers from 1980 to 2017. The choice of this period is due to the limited time available to carry on this study and the researcher wants to closely investigate the economic performance of Sierra Leone.

The study mainly focuses on the effect of real exchange rate on the trade balance of Sierra Leone.

2.1 Theoretical Literature

There is no precise theoretical conclusion on the effects of exchange rate on the balance of payments. This implies that, there are various ways through which exchange rate affects

the trade balance or the balance of payments of any economy. The elasticity approach, which is also known as the relative-price approach, proposed by Beckerdike (1920), Robinson (1947) and Metzler (1948) ^[44] is the earliest among the theories that explain the effects of exchange rate on the balance of payments. This approach denotes that an increase in the nominal exchange rate reduces the relative prices of exports of the domestic country relative to the prices of the same goods produced in other countries. Again, an increase in the nominal exchange rate reduces the price of import-competing goods relative to imports.

This implies that, when a country is faced with a given import price and can expand exports at a fixed cost, increase in the nominal exchange rate increases export and reduces import by changing the relative prices of exports and imports thus improve the trade balance.

The proponents of this approach maintained that from a position of equilibrium in the Beckerdike-Robinson-Metzler (BRM) condition or sometimes referred to as the full Marshall-Lerner condition; an increase in the nominal exchange rate improves the trade balance if the absolute value of the sum of the demand elasticities is greater than unity.

A simplified version of the BRM condition is obtained by assuming that the domestic economy is small; which means that it cannot affect the prices of its exports and imports. Here, the sum of the two foreign elasticities is infinite; that is, an increase in the nominal exchange rate improves the trade balance if the sum of the domestic elasticity of supply of exports and demand for imports is greater than zero.

In most cases, the critical elasticity condition is not satisfied in the short run but in the long run, it is satisfied. It is so because, both the demand and supply elasticities may be greater in the long run than the short run. This is evident from the fact that trade volumes take some time to adjust to new equilibrium levels.

Therefore, an increase in the nominal exchange rate may initially deteriorate the balance of payments and later improves it. The description for this concept is known as the J-curve effect of devaluation.

One among the basic problems with the elasticity approach is the fact that an increase in the nominal exchange rate increases the general price level, but this concern is not captured by this approach.

Also, the income effect of an increase in the nominal exchange rate is not captured by the elasticity approach. An increase in the nominal exchange rate, which increases net exports, increases income. But the increase in income is used to increase imports. Hence, the increase in imports following an increase in income opposes the initial improvement in the trade balance.

Since the net effect of these two opposing forces on the trade balance is unknown, the elasticity approach does not account for the income approach of a change in the nominal exchange rate.

Conclusively therefore, ignoring the income effect in the adjustment mechanism implies that the income effect in this approach is zero.

The Multiplier approach resolves one of the problems in the elasticity approach. That is, lack of income effect in the elasticity approach.

According to the income approach, an increase in the nominal exchange rate indeed increases income since it increases exports and reduces imports. This increase in income flowing from the increase in nominal exchange rate increases imports.

This increase in imports deteriorates the trade balance, thus opposing the initial improvement in the trade balance. The income approach therefore maintains that the net effect of the devaluation of the nominal exchange rate on the balance of payments is unknown as the trade balance increases initially by changing relative prices but decreases later since it increases income when the trade balance improves.

The Laursen-Metzler synthesis (Laursen and Metzler, 1950), as in the case of the income approach, takes the income effect into consideration and analyses the effect of an increase in the nominal exchange rate on the trade balance. This is a synthesis of the elasticity approach and the income approach and is Keynesian in nature since it assumes that prices are rigid.

It provides a condition that an increase in the nominal exchange rate improves the trade balance.

The adjustment process of this approach is also the elasticity approach. Here, the relative-price changes when there is an increase in the nominal exchange rate and this increases income as it improves the trade balance by increasing exports and reducing imports. The increase in income increases imports, thus deteriorating the trade balance as in the income approach. Here, the initial improvement in the trade balance from the relative price changes is opposed by the increase in imports arising from the increase in income.

The problem with the Laursen-Metzler synthesis is that it does not take into consideration the effects of exchange rate depreciation on the general price level. Thus, it assumes that the only reason for an increase in nominal exchange rate not to improve the trade balance when critical elasticity conditions are met is the fact that the income effect (negative) detracts from the initial relative price effect (positive).

The Absorption approach was brought forward by Alexander, in 1952. It examines the effects of an increase in the nominal exchange rate on the balance of payments by considering the relative effects of an increase in the exchange rate on income and absorption. It maintains that devaluation of domestic currency improves the trade balance if; it increases income more than absorption, it reduces absorption more than income or it increases income and reduces absorption.

The effect of the increase in the nominal exchange rate on absorption occurs through increase in spending, which arises from the increase in income that follows devaluation. This is referred to as the indirect effect of devaluation on absorption.

The effect of devaluation of the nominal exchange rate on absorption also occurs through increase in prices, which affects absorption directly through the real balance effect or the money illusion effect. This is the direct effect because it affects absorption not through change in income.

The real balance assumes that, as the exchange rate increases, the price level increases and real balance therefore decreases. Hence, in order to restore real balances, absorption must be reduced.

Just as in the case of the elasticity approach, income approach and Laursen-Metzler synthesis, the absorption approach points that the effect of devaluation on the trade balance is ambiguous. This is because, both the qualitative and quantitative impacts of a change in nominal exchange rate on both income and absorption are unknown.

Unlike the elasticity, income, Laursen-Metzler and absorption approaches, the monetary approach analyses the effect of the exchange rate on the balance of payments by taking the money market into consideration and assuming

that the Purchasing Power Parity (PPP) concept holds. Again, it considers the overall balance of payments, proxy by foreign reserves, while the other approaches consider the trade balance as the balance of payments (the capital account and net income). It assumes that in the short run, an increase in the nominal exchange rate improves the balance of payments but the monetary consequence of the balance of payments ensures that the improvement is neutralized by deterioration of the balance of payments. Hence, an increase in the nominal exchange rate improves the balance of payments in the short run with neutral long run effect.

2.2 Empirical Literature

There is widespread empirical research on the effects of exchange rate on the balance of payments, but the findings and results are diverse.

Cooper (1971)^[25], finding is recognized as the first empirical evidence. Cooper examined the effect of 24 devaluations in 19 developing countries for the period 1959-1966 by examining the direction of the trade balance and the overall balance of payments after devaluation. His result showed that devaluation improves the trade balance and the balance of payments.

But Cooper did not distinguish between the short run and the long run effects of an increase in the nominal exchange rate on external sector performance.

Also, he did not control for the effects of other variables on the trade balance and the balance of payments.

Laffer (1976)^[42], accounted for both the short run and the long run effects of devaluation on the trade balance. He examined the path of the trade balance over three years before devaluation, for the year of devaluation and three years after the year of devaluation. Laffer found just little evidence in favour of an increase in the nominal exchange rate improving the trade balance in the year of the change in the exchange rate in the short run and three years after the year of the change in the long run. He then concluded that there is no evidence of the J-curve effect of devaluation. This implies that, a change in the nominal exchange rate is not effective in improving the balance of payments.

Many empirical studies have taken the drawbacks of the pioneering empirical study into consideration. For instance, Connolly and Taylor (1976)^[24] used 16 of the devaluations in the Cooper sample and controlled for other macroeconomic variables by the use of domestic credit expansion. They observed the direction of the overall balance of payments, which they defined as the net change in reserve, following devaluation. They also found that devaluation is associated with improvement in the overall balance of payments and the higher the rate of domestic credit expansion after devaluation, the smaller the improvement in the balance of payments.

Salant (1976)^[51] also accounted for both the short-run and the long-run effects of an increase in the nominal exchange rate on the trade balance and the balance of payments by investigating the path of the trade balance and the balance of payments three years after the increase in the nominal exchange rate. Salant's findings showed that devaluation improved the trade balance for the three years of devaluation in less than one half of the countries in his desired sample. The implication of this is that, devaluation is not effective in improving the balance of payments.

However, even though both Laffer and Salant examined both the short run and long run effects of an increase in the

nominal exchange rate, they did not control for the effects of other variables in their respective studies.

Miles (1979)^[45] was the first to consider the short-run and long-run effects of an increase in the nominal exchange rate on the trade balance and the overall balance of payments and also controlled for the effects of other macroeconomic variables. Thus, correcting for the weakness pictured on the works of Cooper (1971)^[25], Laffer (1976)^[42] and Salant (1976)^[51]. Miles used Seemingly Unrelated Regression (SUR) techniques on a panel of 14 developed countries that devalued their currencies in the 1960s. His study revealed that devaluation improved the balance of payments but not the trade balance. He applied econometric analysis in his study but he did not capture the various macroeconomic interactions following an exchange rate variation.

Most of the studies in the 1980s and 1990s in relation to the effects of exchange rate on the balance of payments were on the developed countries and the results were not uniform. For instance, Rose and Yellen (1989)^[50], by using United States data from 1960 to 1985 and Felmingham (1988)^[32] by applying an unrestricted distributed lag model to the Australian data from 1965 to 1985 found that an increase in the nominal exchange rate does not improve the trade balance even in the long run.

Other studies carried out in the U.S. and other developed countries found that devaluation improves the trade balance or the balance of payments at least in the long run. Such studies include Marwah and Klein (1996)^[39] who applied Vector Auto-Regression (VAR) to the U.S. data, Demirden and Pastine (1995)^[56], who employed disaggregated data for both the U.S. and Canada for the period 1977 to 1992 using Instrumental Variable (IV) and Ordinary Least Square (OLS), Guptar-Kapoor and Ramakrishnan (1999)^[37], who employed a Vector Error Correction Model (VECM) followed by impulse analysis for Japan, and Boyd *et al* (2001)^[22], who used structural Cointegrating Vector Auto-Regressive Distributed Lag (VARDL) models from 8 OECD countries.

However, none of these studies focused on the behaviour of the macro economy following a change in the nominal exchange rate.

Following the work of Upadhyaya and Dhakal (1997)^[38] for Colombia, Cyprus, Greece, Guatemala, Mexico, Morocco, Singapore and Thailand, series of studies have extended the works of earlier authors on the effects of exchange rate on the balance of payments to less developed countries using VAR and Cointegration techniques after the 1990s. Even though the methodologies employed were similar, but the respective results obtained were not uniform. Some obtained positive effect of devaluation of the exchange rate on the balance of payments in the long run, while others found negative effect. Gylfason and Risager (1984)^[55], Musila and Newark (2003)^[47] and Taye (1999)^[57] all used Macro-simulation frameworks in their studies to examine the effects of exchange rate on the balance of payments. They found that an increase in the nominal exchange rate does not improve the trade balance and Branson (1986) found that whenever a currency is devalued, it improves the trade balance.

Most of the empirical studies carried out on the effect of exchange rate on the balance of payments did not say much about Sierra Leone.

Rawlins and Praveen (1993)^[49] investigated the impact of real exchange rate devaluation on the trade balance of Sierra Leone and other 18 African countries. They specified and

estimated an Almon Distributed Lag (ADL) process of trade balance using annual data that consists of both monetary policy and fiscal policy variables. Their finding suggests that, real exchange rate depreciation, improves the trade balance of Sierra Leone. But their study did not distinguish between the effects of a depreciation of the nominal exchange rate.

Demirden and Pastine (1995)^[56], did a research on exchange rate and trade balance. They concluded that the exchange rate is considered as a tool for regulation of trade balance, which ultimately affects national income, and welfare of a nation and hence the size on the effects of changes in exchange rates is critical information for trade balance and exchange rate policymakers.

Andersson (2010)^[10], in his study pointed out that one of the policies used is currency devaluation under free exchange rate regime which is expected to eliminate persistent trade deficits by decreasing prices of the home country's exports abroad and increase the price of imports at home, inducing export quantity to rise and import quantity to decrease, thereby influencing the trade balance certainly. However, the impact of the exchange rates can be different in the long-run compared to the short-run due to the slow adjustment of the trade quantity to the new exchange rate level i.e. J-Curve theory. This theory states that after a real depreciation or devaluation of exchange rate, the trade balance is expected to deteriorate first due to increased import value in terms of domestic currency and sticky prices. With time, the volume of exports will increase and the volume of import will decrease when adjusting for the new exchange rate and the trade balance will then be improved.

Gunersen (2014)^[36] studied the effect of exchange rates on exports and imports of emerging countries using panel Cointegration method for the period 1985–2012. He showed that, there was Co-integration between real effective exchange rate and export-import of emerging economies in the long-run. In total, 5 of these emerging countries (Bolivia, Cameroon, Dominica, Gabon and Mexico) have both long run relationships and short-term parameters and are statistically significant. He concluded that exchange rate effects support the theoretical expected results for the selected emerging countries.

Kamoto (2006)^[31] investigated the effects of devaluation on the trade balance in Malawi and South Africa using Vector Error Correction Model (VECM) and generalized impulse response functions to trace the response of the trade balance to the shocks in the exchange rate. He found the existence of a long-run equilibrium positive relationship between trade balance and the real effective exchange rate, indicating that a real depreciation will improve the trade balance in the long run for both Malawi and South Africa.

However, Rawlins (2008)^[35] examined the relationship between the trade balance and the real exchange rate in two regions of the western hemisphere: Central America, the Caribbean, and a bilateral approach between a panel of 12 countries from the region and each of four industrialized countries; The U.S, Britain, France and Japan. After a close review of the history of the trade balance and of individual cases of devaluation, he employed OLS and the Fisher-Johansen Panel Cointegration technique to investigate the existence of a stable long-term relationship between bilateral currency depreciations, income levels and the trade balance for the panel data he used. He found out that currency devaluations do not affect the trade balance positively.

Alege (2011)^[6], in his study of the investigation on the

effects of exchange rate on the foreign trade of some selected African countries in a panel Cointegration approach, found that export and import are inelastic to changes in exchange rate. It follows that depreciation of currencies in the region may not have the expected results in view of composition of our exports. In the same view, depreciation would only aggravate imports of the region. Thus, in light of the findings, a policy of exchange rate stability, which hinges on extensive institutional and technological capacity as well as the maintenance of comprehensive coherent macroeconomic packages remain a critical factor in ensuring that exchange rate policy performs its central role as a trade facilitation tool. In a similar way, Bahmani and Brooks (1999)^[15, 16] investigated the impact of real exchange rate depreciation on trade balance of Pakistan with her 13 largest trading partners. The study used disaggregated quarterly data of 1980 to 2003 on a bilateral basis to avoid the aggregation bias problem. The study employed two econometric techniques for this rationale i.e. bound testing technique and Johansen's Cointegration technique. He found that almost half of the trading partners including two largest trading partners, i.e. China and UAE were hurt by depreciation of Pakistan's currency. In addition, he said Cointegration approach did not provide any significant long-run impact on bilateral trade balance in response to real exchange rate depreciation, which proves no indication in favor of J-curve phenomenon in Pakistan.

Adeyemi *et.al* (2013)^[3], studied the impact of currency devaluation on Nigeria trade balance using Johansen Cointegration and variance decomposition methods on data spanned from 1970-2010 and found an inelastic and significant relationship between trade balance and its exchange rate in the long run.

However, Genemo (2017)^[40], investigated the effect of exchange rate on trade balance in Major East African Countries, using evidence from panel cointegration. His study indicates that there exists a long-run stationery relationship between trade balance and its determinants on foreign and domestic income, nominal exchange rate, as employed in his study. His study's major findings include; nominal exchange rate induces inelastic and significant relationship on trade balance in the long-run and concluded that the trade balance deteriorates with increasing depreciation of exchange rate (as a value effect in East African countries).

The literature on the effects of exchange rate on the balance of payment (considering both theoretical and empirical evidences), has always been a wide area of study, but just a little is known for Sierra Leone – even with the application of series of methodologies.

3.1 Model Specification

The empirical model adopted for this study is given by:

$$TBAL = \beta_0 + \beta_1 REER_t + \beta_2 RGDP_{gt} + \beta_3 XPORT_t + \beta_4 MPORT_t + \beta_5 ABSO1_t + \beta_6 RABS_t + \beta_7 US_GDP_t + \beta_8 RVOL_t + e \dots \dots \dots (1)$$

To estimate the impact of the regressors on the regressand, we introduce natural logarithms to equation (1). This will enable us interpret our results in terms of elasticities. The empirical natural logarithmic model adopted in this study is:

$$\ln TBAL = \beta_0 + \beta_1 \ln REER_t + \beta_2 \ln RGDP_{gt} + \beta_3 \ln XPORT_t + \beta_4 \ln MPORT_t + \beta_5 \ln ABSO1_t + \beta_6 \ln RABS_t + \beta_7 \ln US_GDP_t + \beta_8 \ln RVOL_t + e \dots \dots \dots (2)$$

Where;

\ln is natural logarithm

$TBAL_t$ is trade balance at time t

$REER_t$ is real effective exchange rate at time t

$RGDPg_t$ is real gross domestic product growth at time t

$XPORT_t$ is export at time t

$MPORT_t$ is import at time t

$ABS01_t$ is absorption at time t

$RABS_t$ is rate of absorption at time t

US_GDP_t is United States gross domestic product at time t

$RVOL_t$ is real exchange rate volatility at time t

e is the error term

3.2 Variables Definition, Measurement and a Priori Expectation

1. Trade Balance (TBAL)

The trade balance, also known as the balance of trade (BOT), is the calculation of a country's exports minus its imports.

When a country imports more than it exports, the resulting negative number is called a trade deficit. When the opposite is true, a country has a trade surplus.

The trade balance is used to help economists and analysts understand the strength of a country's economy in relation to other countries.

A country with a large trade deficit is essentially borrowing money to purchase goods and services, and a country with a large trade surplus is essentially lending money to deficit countries. In some cases, the trade balance correlates with the country's political stability because it is indicative of the level of foreign investment occurring there.

2. Real Effective Exchange Rate (REER)

The effective exchange rate measures a currency against a basket of other currencies. This is usually trade-weighted. When looking at the effective Leone exchange rate, we will compare the value of the Leone against our main trading partners – The Euro, the Pound Sterling, the Dollar, the Yen etc. and give a weighting depending on how much we trade with that country. A weighting will be given to different trading countries depending on how significant they are.

The effective exchange rate is good for looking at the overall performance of a currency. For example, the Leone may appreciate against the Dollar – but this may be due to just temporary weakness in the Dollar. However, if the overall effective exchange rate increases, it suggests the Leone is becoming stronger.

- If a country's real exchange rate is rising, it means its goods are becoming more expensive relative to its competitors.
- An increase in the real exchange rate means people in a country can get more foreign goods for an equivalent amount of domestic goods.
- Therefore an increase in the real exchange rate will tend to increase net imports. Foreigners will buy our less expensive exports. It now becomes more attractive to buy imports. This can cause a widening of the current account deficit and lower domestic Aggregate Demand. It will also help reduce inflation.
- Similarly, a fall in the real exchange rate should increase net exports as domestic goods are more competitive and hence positively affects the trade balance.

3. Imports (MPORT)

Imports are foreign goods and services bought by residents of

a country. Residents include citizens, businesses, and the government. It doesn't matter what the imports are or how they are sent. They can be shipped, sent by email, or even hand-carried in personal luggage on a plane. If they are produced in a foreign country and sold to domestic residents, they are imports.

If a country imports more than it exports it runs a trade deficit. If it imports less than it exports, that creates a trade surplus. When a country has a trade deficit, it must borrow from other countries to pay for the extra imports.

4. Exports (XPORT)

Exports are the goods and services produced in one country and purchased by residents of another country. It does not matter how they are sent. It can be shipped, sent by email, or carried in personal luggage on a plane. If it is produced domestically and sold to someone in a foreign country, it is an export.

Exports and Imports make up a country's trade balance. When the country exports more than it imports, it has a trade surplus.

5. Real Gross Domestic Product growth (RGDPg)

This is a measurement of economic output that accounts for the effects of inflation or deflation. It provides a more realistic assessment of growth than nominal GDP. When the GDP growth rate is slowing down or even contracting, the Central Bank will lower interest rates to stimulate growth. Declining GDP growth rates can also lead to a recession, which will increase the unemployment rate and negatively affects the trade balance.

6. Absorption (ABS01)

This refers to the total level of spending in an economy. It includes import spending but excludes exports. Absorption includes spending on all goods and services. Countries with a high marginal propensity to consume (MPC) tend to have a high absorption rate. If absorption is greater than production then there will be deterioration in the current account balance of payments.

7. Rate of Absorption (RABS)

The absorption rate is the rate at which available homes are sold in a specific real estate market during a given time period. It is calculated by dividing the average number of sales per month by the total number of available homes. The figure shows how many months it will take to exhaust the supply of homes on the market.

8. Exchange Rate Volatility (RVOL)

The rate at which one currency is converted into another is an exchange rate. How rapidly the exchange rate fluctuates is its volatility. In general, the amount of money you are dealing with may dictate your sensitivity.

9. United States Gross Domestic Product (US_GDP)

This is the Gross Domestic Product of the United States normally used for comparative studies as all countries trade in U.S. dollar. It is also referred to as world GDP and taken as proxy for our study.

3.3 Estimation Techniques

To estimate the empirical model, (equation 2), we will use the advanced Autoregressive Distributed Lag model (ARDL)

Bounds test developed by Pesaran, Shin and Smith (2001). The ARDL Bounds test is more robust in testing for cointegration in smaller data samples. Another importance of the ARDL estimation technique is its effectiveness in cases where the variables in the model are either stationary at levels, I(0) or are stationary after first difference, I(1).

The general ARDL model is:

$$\Phi(L, P)Y_t = \sum \beta_i(L, q_i) X_i + \delta W_t + \mu_t \dots \dots \dots (3)$$

Where;

Y_t is the dependent variable

X_i is a vector of independent variables
 $i = 1, 2, 3$

L is the lag operator

W_t is a ($g \times 1$) vector of deterministic variables.

We will test for the presence of cointegration in equation (3).

In the event the results support a long-run relationship, we will use an Error Correction Model (ECM). We can therefore write our ECM as:

$$\Delta Y_t = C + \sum_{i=1}^p \beta_i \Delta Y_{t-1} + \sum_{i=0}^p \alpha_i \Delta X_{t-1} + \delta ECT_{t-1} + \mu_t \dots \dots \dots (4)$$

Where;

Δ is the difference parameter

Y_t is the trade balance

X_t is the vector of explanatory variables specified above

β_i and α_i are the short-run parameters

δ measures the speed of adjustment to long-run equilibrium and the same should be statistically significant with a negative sign on the coefficient

ECT_{t-1} relates to the lagged residual of the long-run regression model

μ_t is the random error term which is independently and identically distributed.

3.4 Pre-Estimation Tests

The study adopted the following pre-estimation tests:

3.4.1 Normality Test

In this study, we employed the Jarque-Bera test in examining the normality of our series. This test is important because it indicates whether the data is normally distributed or not. To address issues of non-normality of our series, the study transformed the continuous variables into natural logarithm as specified in equation (2).

3.4.2 Optimal Lag Selection Criteria

Time series analysis requires that there be an appropriate lag length selected based on an information criterion. In this study, we applied the Vector Autoregressive Lag Selection Order Criteria (VARSOC) to estimate the optimal lag length. We made use of the Akaike Information Criterion (AIC) in selecting the optimal lag length. The motivation for the AIC is due to parsimony. That is, it gives the lowest number of lags when compared to the Final Prediction Error Criterion or the Swartz or Hannan Quinn Information Criterion.

3.4.3 Unit Root Test

Although the Bounds test does not require pre-testing of our variables to see whether they are time dependent or not, we nevertheless applied it in the study because it cannot be used when the series are integrated of order two or more. This approach is necessary to avoid the problems of spurious results and inconsistent estimates. The ADF test for unit root was then employed in this paper. In cases where a unit root is detected, then we differenced appropriately until the series became stationary at 5% level.

3.5 Post-Estimation Test

3.5.1 Model Stability Test

The stability of a time series model is cardinal for forecasting or prediction purposes. To ascertain the robustness of our model, the study adopted two graphical tests. These are CUSUM and CUSUM SQUARES. The former stands for cumulative sum of recursive residuals while the latter stands for cumulative sum of recursive residuals square test. These are graphical tests for analyzing the validity of the existing relationship.

Generally, if our graph lies within the red dotted lines, we do not reject the null hypothesis. Therefore we conclude that the parameters are stable over time. Conversely, if our graph falls outside the two red dotted lines, then our model is not stable. Hence, we cannot use it for forecasting purposes.

3.6 Data Types and Sources

Data for this study was elicited from the World Development Indicators (2018), and the Bank of Sierra Leone for the study period 1980-2017 as guided by data availability. Data for all variables are measured in nominal terms.

4.1 Descriptive Statistics

The study investigated the effect of real exchange rate on the trade balance of Sierra Leone over the period 1980 to 2017. The results of the first moment statistics, Min & Max values and Standard Deviation are reported in table 1.

Table 1: Descriptive statistics

	TBAL	REER	RGDPg	XPORT	MPORT	ABS01	RABS	US_GDP	RVOL
Mean	0.563268	164.9383	2.419895	18.70995	4.78E+08	111.8331	6.37E+12	1.21E+13	26.52541
Median	0.561805	122.3946	3.7215516	18.74276	1.97E+08	110.4398	5.11E+12	1.25E+13	10.76508
Max.	1.090909	560.3869	26.71732	21.37401	1.78E+09	148.1836	1.33E+13	1.73E+13	169.3905
Min.	0.073684	90.724110	-20.59877	15.60727	81000000	85.66973	3.56E+12	6.57E+12	1.734015
S.D.	0.311868	117.2211	8.849088	1.328104	5.29E+08	13.90620	3.06E+12	3.26E+12	38.29616
N	36	36	36	36	36	36	36	36	36

Source: Authors' own computation based on WDI 2018.

The wide margin between exports and imports points to the current account imbalances that the country faces with the

rest of the world as it consumes more foreign goods and services than it trades with the rest of the world. This simply

means that the economy is spending more than it receives in revenue from its exports. Such a situation is undesirable for long term economic growth and development. Measures should therefore be adopted to increase exports such as exports promotion, trade fairs, export processing zones, product diversification among others. Alternatively, the government could make use of fiscal measures (such as tax increases to discourage spending on imports), adoption of monetary policies like devaluation of the Leone so as to switch spending away from imports while at the same time making exports attractive to foreigners, thereby increasing exports and economic growth in Sierra Leone. Lastly, the government could also adopt direct controls such as quotas and import tariffs.

4.2 Normality Test

To ensure that our estimated coefficients provide statistically meaningful results, we provided Normality tests which are depicted in table 2 below.

The study adopted the Jarque-Bera statistic in ascertaining the normality of our series. The null hypothesis is that the series are normally distributed. The decision to accept or reject this hypothesis depends on the Jarque-Bera P-value. If the P-value exceeds 5%, we conclude that the series has a normal distribution. Otherwise, we will conclude that the series is not normally distributed. All the variables included in the series were observed for 36 years and were tested at levels. The normality test results are shown below.

Table 2: Normality test results

	TBAL	REER	RGDPg	XPORT	MPORT	ABS01	RABS	US_GDP	RVOL
Skewness	0.0220	2.2727	-0.1258	2.6151	1.4954	0.6000	1.2560	-0.0781	2.2314
Kurtosis	1.7880	6.8855	4.8040	9.2944	3.7299	3.2166	3.1458	1.6635	7.4383
Jarque-Bera	2.2065	53.6369	4.9767	100.4627	14.2161	2.2306	9.4968	2.7161	59.4231
Probability	0.3318	0.0000	0.0830	0.0000	0.0008	0.3278	0.0087	0.2572	0.0000
Obs.	36	36	36	36	36	36	36	36	36

Source: Authors' own computation based on WDI, 2018.

From the table above, only TBAL, RGDPg, ABS01, US_GDP were found to exhibit normal distribution. The rest; REER, XPORT, MPORT, RABS and RVOL were not

normally distributed as their P-values are less than 5%. In order to overcome this problem, we therefore transform the series in logarithmic form.

Table 3: Correlation matrix

	TBAL	REER	RGDPg	XPORT	MPORT	ABS01	RABS	US_GDP	RVOL
TBAL	1.0000								
REER	0.2843	1.0000							
RGDPg	-1.0011	-0.1334	1.0000						
XPORT	0.4132	-0.1449	0.3475	1.0000					
MPORT	0.1114	-0.2377	0.2527	0.8435	1.0000				
ABS01	-0.2958	-0.2042	0.2945	0.5158	0.7709	1.0000			
RABS	0.1808	-0.1997	0.2998	0.8462	0.9410	0.7935	1.0000		
US_GDP	-0.2843	-0.6183	0.2892	0.5392	0.7124	0.7391	0.7501	1.0000	
RVOL	0.4436	0.5879	-0.0369	-0.1731	-0.3027	-0.2747	-0.2747	-0.6237	1.0000

Source: Authors' own computation based on WDI, 2018.

The results from table 3 seem to corroborate the dictates of economic theory for most of the explanatory variables. It is observed that, REER, XPORT, MPORT, RABS and RVOL have positive relationship with TBAL. Conversely, RGDPg, ABS01 and US_GDP have negative relationship with TBAL.

4.3 Lag Selection Criterion

In order to avoid the problems of serial correlation among our series, it is recommended that we select an optimal number of lags. This study made use of the Akaike Information Criterion as a basis for selecting our optimal lags. The results are depicted in table 4 below. Selecting an optimal lag is crucial in addressing issues associated with serial correlation, multicollinearity and misspecification of the model.

Table 4: Lag selection criterion results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3990.811	NA	1.23e+91	235.2830	235.6870	235.4208
1	-3730.870	366.9757	3.88e+86	224.7570	228.7974	226.1349
2	-3518.860	187.0677*	5.45e+83*	217.0506*	224.7273*	219.6685*
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Source: Authors' own computation based on WDI, 2018.

From table 4 above, it could be observed that the appropriate lag length for our study is 2. Since AIC conforms to the parsimonious criteria, we therefore adopted it for our analysis. The need to adopt an optimal number of lag stems from the fact that, using excessively large lag lengths will lead to autocorrelation among our residual errors, trigger multicollinearity and erode the degree of freedoms which increases the chances of discrediting our model because of poor explanatory power. Hence, we adopted the parsimonious criterion given by the AIC criterion.

4.4 Unit Root Test

A distinct feature of time series data is that they tend to be time dependent or non-stationary. A series is non-stationary when its mean, variance and covariance changes over time. In other words, the series is said to exhibit a random walk or

has unit root or is time dependent. An undesirable consequence is that, the estimated coefficients will be spurious and inconsistent. This is exactly why it is deemed necessary to check for unit roots. In this study, we employed the ADF test statistic using 5% level of significance to examine whether our series are stationary or not. If they are stationary, we will be able to determine the order of integration. Using the ADF test statistic, the null hypothesis is that the series has unit root. This is tested against the 5% level of significance. Generally, when the ADF test statistic is less than the 5% level, we do not reject the null hypothesis and conclude that the series has unit root or is non-stationary. In the following table, (d) denotes the difference operator and is used to transform a non-stationary series to a stationary series.

Table 5: Unit root test results

Variable	Test Statistic	Probability Value	1% Critical Value	5% Critical Value	10% Critical Value	Conclusion
Tbal	-2.19	0.21	-3.62	-2.94	-2.61	I (1)
dTbal	-5.23	0.0001				I (0)
Reer	-2.44	0.1374	-3.626	-2.945	-2.611	I (1)
dReer	-4.15	0.0026				I (0)
Rgdpg	-5.468	0.0001	-3.626	-2.95	-2.611	I (0)
Rvol	-1.77	0.38	-3.646	-2.95	-2.611	I (1)
drvool	-3.022	0.0434				I (0)
Xport	-1.35	0.59	-3.62	-2.94	-2.611	I (1)
dXport	-3.97	0.0040				I (0)
Mport	-0.8489	0.793	-3.62	-2.94	-2.61	I (1)
dMport	-5.69	0.0000				I (0)
Abs01	-0.724	0.0.8279	-3.62	-2.94	-2.61	I (1)
dAbs01	-8.16	0.0000				I (0)
Rabs	0.8231	0.9931	-3.62	-2.94	-2.61	I (1)
dRabs	-6-21	0.0000				I (0)
US_GDP	-0.718	0.9450	-3.62	-2.94	-2.61	I (1)
dUS_GDP	-4.096	0.0029				I (0)

Source: Authors' own computation based on WDI, 2018.

A striking feature of our ADF test results in the above table is that only one of our nine series, RGDPg was found to be stationary at levels. We therefore do not accept the null hypothesis. In other words, RGDPg does not have unit roots in its original form. By contrast, all the remaining variables (Tbal, Reer, Xport, Mport, Rvol, Rabs, Abs01, and US_gdp) are non-stationary at levels. These means that, they are all having unit roots at levels. We therefore do not reject the null hypothesis. We therefore do first differencing on these variables so as to make them stationary. It could therefore be observed that, immediately after first differencing, the variables became stationary. Therefore, our regressors, (Reer, Xport, Mport, Rvol, Rabs, Abs01, and US_gdp) as well as our regressand (Tbal) are said to be order 1 series. Hence, the series are appropriate for causality and cointegration analysis under the ARDL Bounds test framework. Essentially, this means that there is a long term relationship between our series.

4.5 The Bounds Test

This test enables us to ascertain the existence of a long-run relationship among our variables. Using this test, when the calculated F-value falls within the lower bound or I(0) bound, then it means there is no long-run relationship. In such a scenario, there is no long-run relationship or cointegration. We will therefore estimate the short-run. However, if the

calculated F-value exceeds the upper bound or I(1) bound, then it means we will estimate the long-run equation. The long-run equation captures both the short-run and long-run dynamics of our model. The table below shows results for the bounds test. With our eight explanatory variables, the Bounds test results using Eviews 10 Software, are shown in table 6.

Table 6: Bounds test for cointegration

F-Bounds Test		Null Hypothesis: no levels relationship		
		Asymptotic: n=100		
Test Statistic	Value	Significance	I(0)	I(1)
F-Statistic	10.69421	10%	1.85	2.85
K	8	5%	2.11	3.13
		2.5%	2.33	3.42
		1%	2.62	3.77

Source: Authors' own computation based on WDI, 2018.

The above table depicts the results of our ARDL Bounds test. These results were used in verifying long-run relationship between independent variables and our dependent variable. The null hypothesis for the bounds test is that, there is no long-run relationship between our variables. The hypothesis is upheld only if our computed F-value is lower than the critical bounds value at 5%. From the table, the F value exceeds both the lower and upper bounds at 5%. According

to Pesaran and Smith (2001), we do not accept the null if the calculated F-value exceeds both the I(0) and I(1) critical values. The I(0) value shows the value of our series at levels while the I(1) is the value after first difference of a non-stationary series. We conclude that there is cointegrating

relationship among our series. This finding has empirically deduced one of our objectives that we want to examine the long run relationship among our variables.

We therefore estimated the short and long run equations as they are shown as follow.

Table 7: ARDL short run estimation results

Variable	Coefficient	Std. Error	t-Statistic	Probability
DLOGREER	-0.013512	0.004126	-3.274842	0.0128
DLOGRABS	0.230013	0.110014	2.090761	0.0310
DLOGMPORT	-0.501210	1.06E-10	-2.371592	0.0254
DLOGRGDPG	0.103167	0.032297	3.194321	0.0157
DLOGRVOL	-0.001166	0.000737	-1.582484	0.1256
DLOGXPORT	0.133242	0.010895	12.22943	0.0422
DLOGUS_GDP	-1.950014	0.913314	-2.135097	0.0160
DLOGABS01	-0.013033	0.002157	-6.042886	0.0000
ECT(-1)	-0.846193	0.207267	-4.082622	0.0414

Source: Authors' own computation based on WDI, 2018.

Table 8: ARDL long run estimation results

Variable	Coefficient	Std. Error	t-Statistic	Probability
LOGREER	-0.000273	0.000348	-0.785712	0.0319
LOGMPORT	-1.493460	0.584140	-2.556681	0.0420
LOGRGDPG	1.920206	0.493046	3.894577	0.0599
LOGRVOL	0.086205	0.031008	2.780089	0.1422
LOGUS_GDP	-0.719714	0.321214	-2.240605	0.0063
LOGXPORT	0.167388	0.042324	3.954931	0.0005
LOGRABS	0.621614	0.215314	2.887011	0.0304
LOGABS01	-0.010996	0.004314	-2.549247	0.0168
C	-1.005580	1.017095	-0.988679	0.3316

Source: Authors' own computation based on WDI, 2018.

Tables 7 & 8 present the empirical results for our study. They further show the impact of our dynamic regressors in both the short and long run on the trade balance of Sierra Leone. In the short run, RABS, RGDPG and XPORT were found to exert a positive and statistically significant influence on the trade balance as predicted by economic theory. This means that an increase in these variables will improve the trade balance, holding other factors constant.

On the other hand, REER, MPORT, ABS01 and US_GDP were found to exert a negative and statistically significant impact on the trade balance.

RVOL however, was found to have no impact on the trade balance in both the short and long run.

Specifically, in the short term, the most influential variable that explains the trade balance is MPORT. The results show that a 1 percent increase in imports will worsen the trade balance by 0.5 percent. Interestingly, this was found to be statistically significant at the 5 percent. This result is consistent with the empirical literature which asserts that an increase in imports will dampen the trade balance. It is therefore imperative that policymakers pay attention to factors influencing imports if the trade balance is to be improved. Some of the policy measures to curb adverse trade balance include expenditure switching and expenditure reducing measures. Other policy options include discriminatory tariffs and exchange rate controls among others.

Another striking result from table 7 is the rate of absorption (RABS) with a coefficient of 0.23. Holding other variables constant, it means that a 1 percent increase in the rate of absorption will improve the trade balance by 23 percent in the short run. This is especially so if increase in domestic

spending is directed at boosting exports and increasing output.

The REER was also found to have a negative impact on the trade balance in both the short and long run. However, its impact on the trade balance is more pronounced in the short term than in the long term. For instance, a 1 percent increase in real exchange rate will reduce the trade balance by 0.135 percent. As expected, this result corroborates the works of Lane P.R. *et.al* (2002)^[43] which showed that an improvement in the real exchange rate will worsen the trade balance. This is due to the fact that, real exchange rate appreciation will make imports cheaper relative to exports. As a result, domestic residents are pre-disposed to increase spending on foreign goods. By contrast, an appreciation of the exchange rate will reduce domestic competitiveness of our exports as they become more expensive to foreigners. Hence, exports fall while imports rise. Consequently, the trade balance will decline. Policymakers should therefore consider the adoption of prudent monetary measures to stem on due appreciation of the domestic currency.

Another significant variable that explains the trade balance in Sierra Leone is RGDPG. As elasticity, a 1 percent increase in the RGDPG will increase the trade balance by 0.1 percent, holding other factors constant. Policymakers should focus attention at improving domestic output while at the same time improving macroeconomic fundamentals geared towards bolstering the external sector. Such measure would include increasing domestic competitiveness, price stability, tariffs, among others.

In the short-run, exports were also found to have a positive and statistically significant influence on the trade balance in Sierra Leone. Specifically, a 1 percent increase in exports,

will improve the trade balance by 0.1 percent. This impact is however, much greater in the long-run than in the short-run. Since exports exert a positive influence on the trade balance, it is imperative that policymakers boost exports growth in Sierra Leone. Some of these policies would include the establishment of export processing zones, private sector credit facilities to export related firms, private-public partnership in the export sector, strengthening the capacity of SLIEPA, among others.

Another significant variable of interest that was used to explain the trade balance in Sierra Leone is US_GDP. This was used as a proxy for world income. It was found that, an increase in US_GDP would worsen the trade balance. To be precise, in the short-run, a 1 percent increase in U.S. income will reduce the trade balance by 1.95 percent, holding other factors constant. In other words, a 10 percent increase in U.S. income will reduce the trade balance by 19.5 percent. This could be attributed to FDI and portfolio influence that have a dampening effect on the trade balance in Sierra Leone, especially in the long-run.

Lastly, ABS01 was found to exert a negative and statistically significant influence on the trade balance in both the short and long run. As would be expected, an increase in domestic absorption will increase imports through the multiplier, thereby worsening the trade balance. In terms of elasticities, a 1 percent increase in absorption will reduce the trade balance by 0.013 percent. In other words, a 100 percent increase in absorption or spending will reduce the trade balance by 1.3 percent. Since absorption worsens the trade balance, it is imperative that policymakers consider both expenditure reducing and expenditure switching measures in correcting external imbalances. Typical policies would include tax increase, tariffs and devaluation of the Leone.

In table 8, the long run results showed that, RABS, RGDPG, XPORT and ABS01 were found to exert a positive and statistically significant impact on the trade balance in Sierra Leone. Compared to the short run, RABS were found to have a greater impact on the trade balance in the long run. For instance, whereas a 1 percent increase in RABS improves the trade balance by 0.23 percent in the short run, in the long run, the trade balance will increase by 0.62 percent.

Similarly, RGDPG and XPORT have much greater impact on the trade balance in the long run than in the short run. The most striking result on the trade balance is RGDPG in the long run. From the result, a 1 percent increase in RGDPG will improve the trade balance by 1.92 percent. Policymakers should therefore strive to improve macroeconomic performance such as increasing income growth, employment, productivity, while at the same time maintaining price level stability.

Although RABS, RGDPG and XPORT were found to have a statistically significant impact on the trade balance in the long run, REER, MPORT and US_GDP were found to worsen the external sector performance in Sierra Leone.

The ECT was found to not only have the expected sign, but was also significant at the 5 percent level. This means that, the reversion to long run equilibrium is at an adjustment speed of 84 percent. In other words, 84 percent of deviations of our series from long run equilibrium will be corrected in one year.

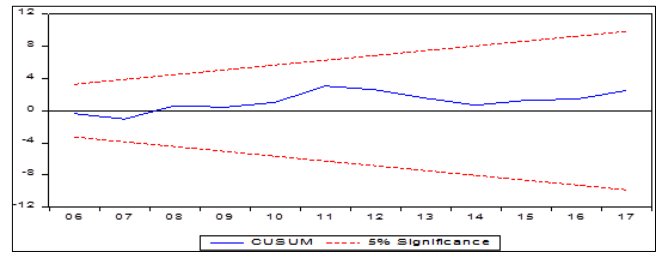


Fig 3: Cusum stability test

The above table depicts the graph of the recursive residuals from the long run equation. Because the blue line falls within the 5% critical bound shown by the two red lines, it means that the model is dynamically stable. Hence, we can make meaningful suggestions for policy purposes. If however the blue line falls outside the red lines, then our model would be dynamically unstable and would have been discarded.

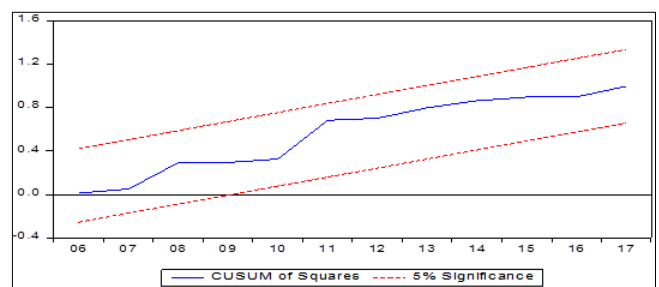


Fig 4: Cusum of squares stability test

To be considered stable, the blue graph should fall within the two bounded red lines; otherwise our model would have been dropped. In our study, the model was found to be statistically well specified and stable. We therefore conclude that the model is dynamically stable and useful for policy purposes.

5.1 Conclusion

This study examines the effect of real exchange rate on trade balance of Sierra Leone using time series data spanning from 1980 to 2017. The study applied unit root test to see how stationary our variables are. After the unit test was used we found out that only one of our series (RGDPG) was stationary at levels while the other variables were not. We therefore did first difference on our non-stationary variable and later found them to be stationary after first differencing. The study used the CUSUM and CUSUM of Squares to test for the stability of our variables. The ARDL Bounds Test was applied to help us achieve our objectives of testing for cointegration relationship and we discovered from our results that there is long run relationship among our variables.

EViews 10 was used in estimating our results and showed that, in the short-run, our following explanatory variables: RABS, RGDPG and XPORT were found to exert a positive and statistically significant influence on the trade balance as predicted by economic theory. This means that an increase in these variables will improve the trade balance, holding other factors constant.

But, REER, MPORT, ABS01 and US-GDP were found to exert a negative and statistically significant impact on the

trade balance, which tells us that, an increase in any of these variables will negatively affect the trade balance. From the results, only one of our variables (RVOL) was found to have no impact on the trade balance in both the short and long-run and therefore no discussion was made on this variable.

The REER was found to have a negative effect on the trade balance in both the short and long-run. However, its impact on the trade balance is more pronounced in the short term than in the long term. For instance, a 1 percent increase in real exchange rate will reduce the trade balance by 0.135 percent. As expected, this result corroborates the works of Lane P.R. *et.al* (2002)^[43] which showed that an improvement in the real exchange rate will worsen the trade balance. This is due to the fact that, real exchange rate appreciation will make imports cheaper relative to exports. As a result, domestic residents are pre-disposed to increase spending on foreign goods. By contrast, an appreciation of the exchange rate will reduce domestic competitiveness of our exports as they become more expensive to foreigners. Hence, exports fall while imports rise.

In the short term, the most influential variable that explains the trade balance is MPORT, which showed that a 1 percent increase in imports will worsen the trade balance by 0.5 percent. The empirical literature which asserts that an increase in imports will dampen the trade balance is in line with our result. RABS as an explanatory variable has a coefficient of 0.23. Holding other variables constant, it means that a 1 percent increase in the rate of absorption will improve the trade balance by 23 percent in the short-run.

As elasticity, a 1 percent increase in the RGDPG will increase the trade balance by 0.1 percent, holding other factors constant. In the short run, exports were also found to have a positive and statistically significant influence on the trade balance in Sierra Leone. Specifically, a 1 percent increase in exports, will improve the trade balance by 0.1 percent. This impact is however, much greater in the long run than in the short run. US_GDP was used as a proxy for world income. It was found that, an increase in US_GDP would worsen the trade balance. ABS01 was found to also have a negative and statistically significant influence on the trade balance in both the short and long run.

In the long run however, RABS, RGDPG, XPORT and ABS01 were positively and significantly impacting the trade balance in Sierra Leone.

Also, RGDPG and XPORT have much greater impact on the trade balance in the long-run than in the short-run. According to our results, the standout result on the trade balance in the long run is RGDPG. Although RABS, RGDPG and XPORT were found to have a statistically significant impact on the trade balance in the long-run, REER, MPORT and US_GDP were found to worsen it.

5.2 Policy Recommendations

There are a number of policy recommendations that can be implemented by policymakers to improve the trade balance of Sierra Leone in both the short run and long run. These policy recommendations are not only limited to the following:

1. Expenditure reducing and expenditure switching: For a country to record a favourable trade balance, its policymakers must be in line to advising the government on how it can allocate its expenditure. Avoidance of non-productive expenditure by the state must be made clear and switching such spending to more lucrative

areas that boost output.

2. Improving macroeconomic stability: This attracts foreign investors and increases productivity which in turn increases exports.
3. Political Stability the state must always be in readiness to maintaining peace for its citizens and foreign investors. When a country's political atmosphere is not stable, foreign investors usually find it difficult to invest in such countries. Hence, deficit trade balance is always recorded, as was experienced in Sierra Leone during the war periods.
4. Policymakers should also strive to improve macroeconomic performance such as increasing income growth, employment, productivity, while at the same time maintaining price level stability.
5. The government should establish export processing zones, private sector credit facilities to export related firms, private-public partnership in the export sector, strengthening the capacity of SLIEPA, among others.
6. Policymakers should consider the adoption of prudent monetary measures to stem on due appreciation of the domestic currency.
7. Policymakers should focus attention at improving domestic output while at the same time improving macroeconomic fundamentals geared towards bolstering the external sector. Such measure would include increasing domestic competitiveness, price stability, tariffs, among others.
8. Local production must be subsidized by the state in order to satisfy local consumption, in a bid to reduce demand pressures on imported products. With this production, the excess is exported and this will positively affect the trade balance of the country.
9. Policies geared towards exchange rate stability should be pursued by policymakers as this will boost exports.
10. Sierra Leone is encouraged to maintain the real exchange rate at its appropriate level that will achieve both internal and external equilibrium. Monitoring real exchange rate movements would serve as a useful tool for the central bank to ensure positive trade balance, macroeconomic stability and growth.

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