# The Effect of Foreign Exchange and Real Exchange Rate on Foreign Trade in Liberia: An Application of Autoregressive Distributed Lag (ARDL) Approach

**Bilgin Bari[1], Emmanuel Dweh Togba[2]**

**Abstract**

In this study, we adopted an ARDL model framework in estimating the effect of foreign exchange intervention and exchange rates on foreign trade in Liberia in three separate models namely export, import and trade balance using yearly data from 1980-2015. The results indicate a statistically significant positive effect of nominal exchange rate on export, but not necessarily for real exchange rate. Nominal exchange rate was confirmed to be inversely related to import while real exchange rate was positively related to import. The trade balance model results show a statistically significant negative effect of nominal exchange rate on trade balance while real exchange rate was seen to be positively related to trade balance. The exchange rate regime change and monetary intervention by the central bank seems ineffective particularly due to the dual currency and high dollarization. The depreciation in the Liberian dollar tend to worsen the trade balance.

**Keywords:** Nominal Exchange Rate, Real Exchange Rate, Foreign Trade, ARDL model, Dual currency

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1 Faculty of Economics and Administrative Science, Anadolu University, Yunus Emre Campus, Eskisehir, Turkey. Email: bbari@anadolu.edu.tr
2 Graduate School of Social Science, Anadolu University, Yunus Emre Campus, Eskisehir, Turkey. Email: edtogba@anadolu.edu.tr

## Introduction

The spread of globalization has been successful so far in connecting economies of the world. Today, the world economies are more linked than decades past through a global market where foreign trade is helping many economies to expand and develop. As these trade transactions tend to increase, technology, labor, capital, good and services are rapidly moving from one economy to another. One main player here is exchange rate—the price of one country's currency in another country's currency. Exchange rate serves as a key determinant of export and import while facilitating trade transactions across borders which can also have triggering effect on inflation and overall macroeconomic stability in an economy. Exchange rate (real) can affect the economy through many channels and consequently, has diverse macroeconomic and developmental impact on any society. In the last three (3) decades, many studies in the fields of international economics, monetary economics and macroeconomics have been focused mainly on the effect of either nominal or real exchange rates on international trade. However, it has been found in most studies that foreign trade[3] movements have been severely affected by exchange rate changes especially in transition and developing economies, Liberia being no exception.

Exchange rate regimes and exchange rate fluctuations could have serious macroeconomic implications in an economy. Theoretically, exchange rate affects inflation, foreign trade, capital account and other key macroeconomic variables. Since the last two decades, many least-developed countries in sub-Saharan Africa continue to experience fluctuations in their exchange rate and at the same time in trade receipts. Foreign exchange rate does influence international trade as examined by many studies. As least-developed country, Liberia's economy continues to experience depreciation of its local currency in the foreign exchange market for the past years. This alarming depreciation of local currency makes foreign commodities more expensive and has the propensitive to affect capital account and subsequently result to deteriorating terms of trade (ToT). This study intends to attempt to examine the effect of the foreign exchange and real exchange rate on foreign trade volume in Liberia and support policy options towards achieving a better monetary policy stance and to also contribute to the existing literature in the field.

## Theoretical and Empirical Relationship Between Exchange Rate and Foreign Trade

The theoretical relationship between exchange rate volatility and foreign trade balance has sparked serious debate in international economics for the past decades. Studies on the topic show that exchange rate volatility can have both positive and negative effect on the

3Foreign trade and international trade are used interchangeably throughout this study.

volume of trade. However, recent studies have been concerned with the reverse causality between exchange rate and foreign trade and on the "pass-through" effect exchange rate has on inflation. Countries of the world make available goods and services for sale to each other based on the mutual benefits that are associated with trade. These gains from trade allow countries to specialized in the production of certain goods and services which they have competitive advantage and depend on other countries for other goods and services which they need. By this, all the participants benefit from foreign and thus, the importance of trade is realized. Foreign trade adversely affect the owners of resources that are "specific" to industries that compete with import, that is, cannot find alternative employment in other industries. Trade has the propensity to alter the distribution of income between broad groups, such as workers and owners of capital. For one country to trade with another, exchange rate serves as a useful tool that allow people to compare the prices of goods and services produced in different countries and subsequently make purchase (Krugman, Obstfeld and Melitz, 2015 p. 234).

The trend in the exchange rate for many countries aound the world in the past decades has been alarming. Foreign exchange rates for developing and developed countries have been highly volatile since the abandonment of fixed exchange rates in March 1973, following the U.S. dollar devaluation in February 1973. One major and critical question that is yet to be answered by many economists has been the effect of such high exchange rate volatility on the growth of foreign trade (Augustine C. Arize *et al*., 2012). This has been and may continue to be the subject of major concern for the next decade to come. Exchange rate volitality can have both negative and positive effect on the growth of foreign trade. Exchange rate volatility in this sense may be defined as the risk associated with unexpected movements in the exchange rate.[4] As one of the most volatile macroeconomic variables, changes in real exchange rate have pervasive effects, with huge consequences for prices, wages, interest rate, productivity level and employment opportunities. Accordingly, large and unpredictable changes in exchange rates present a major concern for macroeconomic stabilization policy within an economy.

The liberalization of capital flows in the last two decades and the enormous increase in the scale of cross-border financial transactions have increased exchange rate movements. Currency crises in emerging market economies are special examples of high exchange rate volatility. In addition, the transition to a market-based system in places such as Central and Eastern Europen and in other parts of Asia often involves major adjustments in the international value of these economies' currencies. Volatility in exchange rate makes

4See McKenzie (1999)

internatinal trade more difficult because volatility increases exchange rate risk. For example see J.D. Donladi *et al.* (2015); Peter Clark *et al.* (2004) and Augustine C. Arize, (1996). These studies provide evidence that exchange rate has a negative effect on trade volume especially export and that there also exist both short-run and long-run relationship between exchnage rate and trade volume.

In a separate work done by Murat Doganlar (2002) where he examines the impact of exchange rate volatility on export of five Asian countries including Turkey, South Korea, Malaysia, Indonesia and Pakistan. After performing an Engle-Granger residual-based cointegration, he came up with the result that exchange rate volatility reduced real exports for these countries. This means that producers in these countries are, to a larger extend, risk-averse and that they will prefer to sell in domestic markets rather than foreign markets if the exchange rate volatility increases. Additionally, if producers are not very risk-averse, a higher exchange rate may reduce the expected marginal utility of export revenues and therefore leads them to produce less export. Very risk-averse individuals worry about the worst possible outcome. Thus, when risk increases, they will export more to avoid the possibility of a drastic decline in their sale revenues. On another hand, less risk-averse individuals are less concerned with extreme outcomes. They view the return on export activity now as less attractive given the increase in risk and may decide to export (Paul De Granuwe, 1988).

It has also been argued by other empirical researchers that exchange rate volatility has a negative effect on the level of exports. However, while some researchers have been able to argue for the negative effects of exchange rate volatility on exports, others have also been able to argue for positive or no effects at all. In a recent study by D. Serenis and Serenis (2008) it has been pointed out that exchange rate volatility may have no impact on trade and may as well have an effect in some other fashion such as on prices or foreign direct investment. This agrument was also supported by Kyriacos Aristotelous (2001) after studying the biletaral trade issue between the Bristish economy and U.S economy, concluded that, among other things, exchnage rate volatility does not have any effect on export volume. To this end, the debate among economists regarding the effect of exchange rate on macroeconomic variables is yet to reach a conclusion.

Over the years, volatility in real exchange rate (RER) seems to have a significant effect on export and import of goods and services especially in emerging and developing economies. While distance-related costs play an important part in the decision making of firms that are engage in foreign trade and subsequently on the trade volume, fiscal policy tools such as tariffs and import quota could also have enormous impact on trade as well. But however, as evidenced by Okwuchukwu Odili (2015) tariffs may sometimes be ineffective

especially in countries with poor export sector and overdependence on imported goods. This argument was further proven by Kazunobu Hayakawa and Fukunari Kimura (2008) that in intra-East Asian where there is exist the absent of tariff, trade is being discouraged by exchange rate volatility more seriously than the other regions. And secondly, one important source of the discouragement is that intermediate goods trade in international production networks, which is quite sensitive to exchange rate volatility compared with other types of trade, occupies a significant fraction of east Asian trade.

Basically, in simplest form, the real exchange rate can be defined as the nominal exchange rate that takes the inflation differentials among the countries into account. Its importance originates from the fact that it can be used as an indicator of competitiveness in the foreign trade of a country (Yusuf Akan and Ibrahim Arslan, 2008). As studied by Ng Yuen-Ling *et al.* (2009) depreciation of a country's currency has great impact on its trade balance but the impact may vary, probably due to different level of economic development. One of the prominent impacts is the Marshall-Lerner condition, which proposed that real depreciation leads to increases in the trade balance in the long run if sum up value of import and export demand elasticity exceed one. Real depreciation improves the trade balance through two different channels. The first is by increasing the quantity of export. Depreciation of a country's currency reveals that the domestic goods will be cheaper as compared to the foreign goods, thus making export more competitive. Secondly, quantity of imports will eventually decrease, as import is relatively more expensive. Alternatively, amount of export and import may not be responsive at initial period of depreciation. Thus, trade balance may be worsening initially due to decrease in value of export and increase in value of import but improves after some time.

Real exchnage rate volatility may have influence on both export and import in the short-run and long-run. The real exchange rate is one of the essential economic indicators of economy's international competitiveness, and therefore, has a strong influence on a country's foreign trade developments. In particular, the impact of the real exchange rate developments on foreign trade has been a topic of discussions in both developed and developing economies. The relationship between exchange rate movements and trade flows has been studied in a large number of theoretical and empirical papers. Most studies Ulugbek Olimov and Nishanbay Sirajiddinov (2008), Augıstine C. Arize *et al.* (2000) and Hasan Vergil (2002) show that real exchange rate, approximating for exchange rate uncertainty, exert a significant negative effect on trade volume mainly export demand in both the short-run and the long-run.

However, some recent regional studies have been directed towards evaluating the reverse relationship between real exchange rate and trade volume among countries. While

controlling for reverse causality, Christian Broda and John Romalis (2003) realized that deeper bilateral trading relations tend to dampen real exchange rate volatility and are much likely to lead to currency union. A.I Rahutami (2013) provided evidence in a study on the ASEAN Economic Community that exchange rate volatility has no statistically significant on the export and import of ASEAN member states (AMSs).[5] The estimation results also revealed that the increasing trend of term of trade will induce the export value. The home income experience a positively significant effect on import value, but the real exchange rate has a negative significant effect. However, based on the literature reviewed, we cannot, *a priori*, the direction of the effect of nominal real exchange rates on foreign trade in Liberia.

**Monetary Policy and Exchange Rate Regime of Liberia, 1980-2015**

Liberia have a dual currency regime where both Liberian dollar and United States dollar are legal tender. It operates a managed float exchange rate regime with no predetermined path and carried out regular foreign exchange interventions to even out major fluctuations in the exchange rate. The Central Bank of Liberia (hereafter, the CBL) employed a monetary policy focused mainly on maintaining price stability as the primary monetary policy objective. As the only policy tool to help contain inflation at a moderate level, the exchange rate sale auction is reviewed regularly with the aim of enhancing its use in the management of Liberian dollar liquidity. As a mean of implementing prudent monetary policy geared toward maintaining low and stable inflation while ensuring availability of sufficient credit to the private sector by the commercial banks, the CBL made huge credit available to commercial banks and to credit unions by reducing the interest rate and extending the repayment date. This has only help a little in increasing the liquidity of the Liberian dollar in the economy as there has been increasing volatility in the exchange rate of the Liberian dollar vis-à-vis United States dollar in recent years.

**Econometrics Model Estimation, Data collection and Source**

Data on nominal exchange rate (NER), real gross domestic product RGDP, export value index and import value index were obtained from the World Development Indicators (WDI) of World Bank and use either in estimating the effect of real exchange rate on foreign trade or deriving at other variables. Data on exports (X), imports (IM), Inflation, GDP deflators were gathered from the National Account of the United Nations Statistical Division.

5ASEAN is the Association of Southeast Asian Nations comprising of ten (10) Southeast Asian states which promotes intergovernmental cooperation and economic integration amongst members states.

The terms of trade (ToT) for Liberia are calculated as the value of its exports as percent of the value of its imports. An increase in the terms of trade means that the value of exports is increasing relative to the value of imports. The country can afford to buy more imports with the revenue from its exports. Real Gross Domestic Product (RGDP) is the gross domestic product divided by mid-year population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsides not included in the products. Exports of goods and services comprise all transactions between residents of a country and the rest of the world involving a change of ownership from residents to nonresidents of general merchandise, net exports of goods under merchanting, nonmonetary gold, and services. Imports of goods, services and primary income is the sum of goods imports, service imports and primary income payments. The nominal exchange rate is the official annual average of the price of a country's currency measure in other currrency, in this case, the United States dollar. The Real Exchange Rate (RER) for the home country at time $t$ is given as:

$$RER_t = NER_t \frac{P_t}{P^{¿}_t} \quad (1)$$

In equation (1), $RER_t$ is the real exchange rate for Liberia in United States dollar at time $t$, and $NER_t$ is the nominal exchange rate of Liberia measured in United States dollar at period $t$. And $P_t^{¿}$ is foreign consumer price index, and $P_t$ is the domestic price index.[6] The terms of trade which represents the value of the exports of Liberia, relative to the value of its imports is calculated by the following equation:

$$ToT_t = \frac{P_{xt}}{P_{mt}} x100 \quad (2)$$

Here $ToT_t$ is the terms of trade of Liberia at time $t$, $P_{xt}$ is the index of export values of Liberia, and $P_{mt}$ is the index of import values of Liberia at period $t$. The calculation of the term of trade ( $ToT$ ) and the real exchange rate (RER) for Liberia is essential given the unavailability of already computed data. The model to be employ in this study follows the theoretical basis of a model that describe an equilibrium in the goods market in an open economy. It shows the equilibrium level in an economy combining both monetary policy and fiscal policy. This equation can be written as;

6Implicit price deflator is use as a proxy for consumer price index due to the unavailability of consumer price index data for Liberia during the period under consideration. The U.S. inplicit price deflator is used as a proxy for foreign consumer price index.

$$Y = C(Y-T) + I(Y,r) + G - \frac{\Im(Y,\epsilon)}{\epsilon} + X(Y^{¿},\epsilon)$$

In the above equation, consumption, C, depends positively on disposable income $Y-T$ , Investment, *I*, depends positively on output, Y, and negatively on real interest rate, r. Government spending, *G*, is taken as given. And the quantity of imports, *IM*, depends positively on both output, *Y*, and the real exchange rate, **ϵ**. The value of import in terms of domestic goods is equal to the quantity of imports divided by the real exchange rate. And exports, *X*, depend positively on foreign output, $Y^{¿}$ , and negatively on the real exchange rate, **ϵ**.

To achieve our desire objective of this study, we look separately at the effect of nominal exchange rate and real exchange rate on export, import and trade balance and determine whether there exists a J-curve effect for Liberia. To this effect, we employed the below export demand equation:

$$X_t = f(RGDP_{ft}, NER_t, RER_t, ToT_t, Vol_t) \quad (3)$$

Where $X_t$ denotes the total exports at time $t$ , $RGDP_{ft}$ measures the real gross domestic product of foreign country at period $t$ , $NER_t$ represents the average nominal exchange rate of Liberia at time $t$ , $RER_t$ is the real exchange rate of Liberia at period $t$ , $ToT_t$ is the terms of trade of home country at time $t$ , and $Vol_t$ is the exchange rate volatility measure at time $t$ , accounting for movements in the real exchange rate and therefore exchange rate risk overtime. For our import demand function, we adopted the function as used by Nodir Bakhromov, (2011), A. B. Tarawalie, *et al,* (2012) and Hasan Vergil, (2000) and expressed below:

$$\Im_t = f(RGDP_{dt}, NER_t, RER_t, ToT_t, Vol_t, FDI_t) \quad (4)$$

Here in equation (4), $\Im_t$ is total imports of Liberia at time $t$ , $RGDP_{dt}$ denotes the real gross domestic product at period $t$ , and $RSV_t$ is the foreign reserve of Liberia at time $t$ . The rest of the variables remain the same as previously explained. Additionally, in developing the trade balance function, we follow works done by Jana Simakova, (2013), G. Grigoryan, (2015). The trade balance function is given as:

$$TB_t = f(RGDP_{dt}, RGDP_{ft}, NER_t, RER_t, ToT_t, Vol_t) \quad (5)$$

Where $TB_t$ is considered as the ratio of export to import at time $t$ , and the rest of the variables remain the same as mentioned above. Our choice of using the ratio of export to import as a proxy for trade balance is to avoid dealing with negative numbers in an effort to capture the logarithm form of the series. This was also supported by the literature in previous works. We can now construct the long-run functions for export demand, import demand and trade balance in a log-linear form as:

$$lnX = a_0 + a_1 \ln RGDP_{ft} + a_2 \ln NER_t + a_3 lnRER_t + a_4 ToT_t + a_5 Vol_t + \mathcal{E}_1 \quad (6)$$

In equation (6), the all variables maintain their respective meaning as discussed previously. Additionally, it is expected that the estimated parameter, $a_1 > 0$….The long-run import demand function is expressed in the form of:

$$lnIM = \beta_0 + \beta_1 \ln RGDP_{dt} + \beta_2 \ln NER_t + \beta_3 \ln RER_t + \beta_4 \ln ToT_t + \beta_5 \ln FDI_t + \beta_6 Vol_t + \mathcal{E}_2 \quad (7)$$

As per equation (24), we constructed the long-run trade balance function an expressed it in the form below:

$$lnTB = \delta_0 + \delta_1 \ln RGDP_{dt} + \delta_2 \ln RGDP_{ft} + \delta_3 \ln NER_t + \delta_4 \ln RER_t + \delta_5 \ln ToT_t + \mathcal{E}_3 \quad (8)$$

In this function, all the variables maintained their respective definition except $lnTB$ which is considered as the log of the ratio of export to import taking as trade balance so as to avoid negative numbers. This function was developed in line with the literature and followed that of G. Grigoryan, (2015) **a**nd Okwuchukwu Odili, (2015).

**Measuring exchange rate uncertainty**

Despite there seems to be no consensus among researchers on a single method or model use to measure exchange rate volatility, some popular models generally used to measure exchange rate uncertainty are the moving average standard deviation and ARCH or GARCH models. In this study, it is important for us to derive the measure of exchange rate volatility to account for period of high and low exchange rate volatility. This study computed exchange rate volatility by use of the sample standard deviation of the growth rate of real exchange rate as:

$$V_t = \sqrt{\frac{1}{m}\sum_{i=1}^{m} \left(\ln RER_{t+i-1} - RER_{t+i-2}\right)^2} \quad (9)$$

where $m$ is the order of the moving average, $rer_t$ is the ratio of the U.S implicit price deflator ( $P_t^*$ ) to the domestic implicit price deflator ( $P_t$ , multiplied by the yearly nominal exchange rate ( $ner_t$ , expressed as the number of domestic currency units per foreign currency, in this case the U.S dollar. The use of real exchange rate volatility as opposed to nominal exchange rate volatility takes its backing from theoretical basis. Here the order of the moving average, $m = 12$ (Chowdhury, 1993). Studies done by Akhtar and Spence-Hilton (1984), Arize, Osang and Slottji (2000) and Olimov and Sirajiddinov (2008)

used this measure. See also Chowdhurry (1993), Kumar and Dhawan (1991), Bailey, Tavlas and Ulan (1987), Koray and Lastrapes (1989: p. 708) and Peree and Steinherr (1989).

The Autoregressive Distributed Lag (ARDL) model introduced by Pesaran *et al.* (2001) in order to incorporate I(0) and I(1) variables in the same estimation will be adopted in this study. However, if all the variables are stationary I(0) and at the same time non stationary I(1) then it is advisable to do Vector Error Correction Model (VECM), Johansen Approach to cointegration. ARDL models are standard regressions that incorporate lags of both the dependent and explanatory variables as regressors (Greene, 2008). To alleviate such problem, Pesaran and Shin (1999) and Pesaran *et al*. (2001) postulated that cointegrating system could be estimated as ARDL models considering that the variables either be I(0) or I(1), not being required to specify in advance the difference of I(0) or I(1) variables. Firstly, the researcher adopts an ARDL error correction framework for the export model (equation 10), import model (equation 11) and trade balance model (equation 12) that were discussed earlier were constructed in the forms below:

$$\Delta lnX_t = a_0 + \sum_{i=0}^{p} a_{1i}\,\Delta lnRGDP_{f_{t-i}} + \sum_{i=0}^{p} a_{2i}\,\Delta lnNER_{2t-i} + \sum_{i=0}^{p} a_{3i}\,\Delta lnRER_{3t-i} + \sum_{i=0}^{p} a_{4i}\,\Delta lnToT_{4t-i} + \sum_{i=0}^{p} a_{5i}\,\Delta IN$$

1

$$\int \text{¿}_{t-1} + a_{13}\,Shock_{t-1} + a_{14}$$

)

where in equation (10) $a_1, a_2, a_3, a_4, a_5, a_6, a_7$ is the short-run coinfficient of this model and $a_8, a_9, a_{10}, a_{11}, a_{12}, a_{13},$ $a_{14}$ represent the long-run coefficient. The null hypothesis here is $a_8 = a_9 = a_{10} = a_{11} = a_{12} = a_{13} = a_{14} = 0$ , means there exist no long-run relationship amongst the variables. The $ECM_{t-1}$ is considered as the error correction term in time $t-1$ and represent the speed of adjustment in the growth of export. We also construct an ARDL version of our import model from equation (11) in the below form:

$$\Delta IM_t = \beta_0 + \sum_{i=0}^{p} \beta_{1i}\,\Delta lnRGDP_{d_{t-i}} + \sum_{i=0}^{p} \beta_{2i}\,\Delta lnNER_{2t-i} + \sum_{i=0}^{p} \beta_{3i}\,\Delta lnRER_{3t-i} + \sum_{i=0}^{p} \beta_{4i}\,\Delta lnToT_{4t-i} + \sum_{i=0}^{p} \beta_{5i}\,\Delta lnFDI_{5t-}$$

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$$\int \text{¿}_{t-1} + \beta_{15}\,Shock_{t-1} + \beta_{16}\,Vol_{t-1} + \beta_{17}\,ECM_{t-1} + \varepsilon_t \text{¿}$$

$$\beta_{7i}\,\Delta Shock_{7t-i} + \text{¿} \sum_{i=0}^{p} \beta_{8i}\,\Delta Vol_{8t-i} + \beta_9\,lnRGDP_{d_{t-1}} + \beta_{10}\,lnNER_{t-1} + \beta_{11}\,lnRER_{t-1} + \beta_{12}\,lnToT_{t-1} + \beta_{13}\,FDI_{t-1}$$

$$\int \text{¿}_{6t-i} + \sum_{i=0}^{p} \text{¿}$$

)

Here in equation (11), $\beta_1,\beta_2,\beta_3,\beta_4,\beta_5$ , $\beta_6$ , $\beta_7$ , $\beta_8$ is the short-run coefficient of this model at the same time $\beta_9,\beta_{10},\beta_{11},\beta_{12},\beta_{13},\beta_{14},\beta_{15},\beta_{16}$ is the long-run coefficient. The null hypothesis ( $H_0:\beta_9=\beta_{10}=\beta_{11}=\beta_{12}=\beta_{13}=\beta_{14}=\beta_{15}=\beta_{16}=0$ )) denotes that there exist no long-run relationship that exist amongst these variables.The $ECM_{t-1}$ represents is considered as an error correction term in time $t-1$ represent the speed of adjustment of import growth. Below is the ARDL framework for the trade balance model as an attempt to determine the long-run relationships amongst trade balance and exchange rates and to also determine whether there exist a *J*-curve.

$$\int \dot{\iota}_{t-1}+\delta_{15}Si$$

$$\Delta lnTB_t=\delta_0+\sum_{i=0}^{p}\delta_{1i}\Delta lnRGDP_{d_{t-i}}+\sum_{i=0}^{p}\delta_{2i}\Delta lnRGDP_{f_{2t-i}}+\sum_{i=0}^{p}\delta_{3i}\Delta lnNER_{3t-i}+\sum_{i=0}^{p}\delta_{4i}\Delta lnRER_{4t-i}+\sum_{i=0}^{p}\delta_{5i}\Delta lnToT$$

Again, here in equation (12) $\delta_1,\delta_2,\delta_3,\delta_4,\delta_5$ , $\delta_6,\delta_7,\delta_8$ is the short-run coefficient of this model and $\delta_9,\delta_{10},\delta_{11},\delta_{12},\delta_{13},\delta_{14}$ , $\delta_{15},\delta_{16}$ denotes the long-run coefficient. The null hypothesis here is $\beta_9=\beta_{10}=\beta_{11}=\beta_{12}=\delta_{13}=\delta_{14}=\delta_{15}=\delta_{16}=0$ , connotes that the variables are not related in the long-run.The $ECM_{t-1}$ can be considered as the error correction term in time $t-1$ is the speed of adjustment of the trade balance growth rate of.

**Time Series Properties Analysis**

As in any time series data analysis and testing, stationarity tests are usually conducted to determine whether the data are stationary or non-stationary. Whenever data are non-stationary, it implies that the means and variances are not constant over time. In this study, stationarity test was conducted with the aid of the statistical software Eviews 9.5 using the Augmented Dickey Fuller (ADF) test and Phillip-Perron (PP) test methods. Test for stationarity, unit root testing results shows that some of the variables are stationary at level while other are stationary at first difference with confirmation from both ADF test and PP test methods. In addition to the ADF and PP tests conducted, the Break Point Unit Root test was also conducted to complement the ADF and PP tests results since seasonality was initially observed to be present in the dataset. Time series graphs that show seasonality or trend in the data are provided in the appendix. This result was further supported by the Break Point unit root test. Test results for various stationarity tests are available upon request from the authors.

**ARDL Bound Testing Procedures**

When using the ARDL approach to cointegration, the initial step by establishing whether there exist cointegration among the variables. In order to determine such relationship

the F-statistic of the test is usually measure against with the critical value (Pesaran *et al*., 2001; Pesaran and Pesaran, 1997). According to the null hypothesis, there is no long-run relationship among the variabes is rejected when the test statistic falls below the lower bound depending on the order of integration of the variables. Bound test was conducted to determine the relationship among the variables as stated in the previous chapter. The selection of lag length was done using the SBC, AIC and HQ criteria. The results for the export, import and trade balance models show that there is long-run cointegration relationship among the variables since the F-statistic values for all the models are above the upper and lower bound test at various critical values as presented in Table 1.

**Table 1.** *Bound Tests Results for Export, Import and Trade Balance Models*

| | | |
|---|---|---|
| **Panel A.** ARDL Bound Test (Export Model) | | |
| Test Statistic | Value | k |
| F-statistic | 3.676084 | 7 |
| Critical Value Bounds | | |
| Significance | I0 Bound | I1 Bound |
| 10% | 1.92 | 2.89 |
| 5% | 2.17 | 3.21 |
| 2.5% | 2.43 | 3.51 |
| 1% | 2.73 | 3.9 |
| **Panel B.** ARDL Bound Test (Import Model) | | |
| Test Statistic | Value | k |
| F-statistic | 5.682034 | 8 |
| Critical Value Bounds | | |
| Significance | I0 Bound | I1 Bound |
| 10% | 1.85 | 2.85 |
| 5% | 2.11 | 3.15 |
| 2.5% | 2.33 | 3.42 |
| 1% | 2.62 | 3.77 |
| **Panel C.** ARDL Bound Test (Trade Balance Model) | | |
| Test Statistic | Value | k |
| F-statistic | 5.008353 | 8 |
| Critical Value Bounds | | |
| Significance | I0 Bound | I1 Bound |
| 10% | 1.85 | 2.85 |
| 5% | 2.11 | 3.15 |
| 2.5% | 2.33 | 3.42 |
| 1% | 2.62 | 3.77 |

**Source:** *Authors' Computation, 2017*

The results for the three models estimated show that the cointegration equation (ECM) is both significant and negative thus signaling that there exist short-run relationships amongst the variables in various models. For the export model, the results indicate that in the short-run

that nominal exchange, terms of trade, intervention (monetary), exchange rate volatility and U.S GDP are significant in explaining growth in export of Liberia. The export model coefficient of ECM (Cointeq (-1)) term of -0.641 suggests a swift adjustment of approximately 64 percent of disequilibria in the previous year's shock adjust back to the long-run equilibrium level in the current year. As displayed by Table 4.4, nominal exchange rate (NER) appreciation has a positive relationship with export (X) growth. A unit increase in nominal exchange rate (NER) increases export growth (X) by 2.966 units. Additionally, the U.S GDP growth (RGDPf) is also positively related to export (X) growth in Liberia. A unit increase in the GDP growth rate of U.S increases Liberia's export growth (X) by 11.183 units. This is due to the huge trade transactions between the two economies, with United States being one of Liberia major trading partners. Real exchange rate risks, measure as volatility, is positively related to export growth. A unit increase in volatility (Vol) increases export (X) earnings by 2.4%. In the long-run, nominal exchange rate (NER) and the foreign exchange intervention on the foreign exchange market represented by the dummy (INT) are both positively related to export with statistical significant. U.S GDP per capita (RGDPf) and volatility (Vol) also have statistically significant values with an inverse relationship with export.

**Conclusion and Recommendation**

The results for the three models estimated show that the cointegration equation (ECM) is both significant and negative thus signaling that there exist short-run relationships amongst the variables in various models. The results further indicate that in the short-run, nominal exchange, terms of trade, intervention (monetary), exchange rate volatility and U.S GDP are significant in explaining growth in export of Liberia. The export model coefficient of ECM (Cointeq (-1)) term of -0.641 suggests a swift adjustment of approximately 64 percent of disequilibria in the previous year's shock adjust back to the long-run equilibrium level in the current year. As displayed by Table 4.4, nominal exchange rate (NER) appreciation has a positive relationship with export (X) growth. A unit increase in nominal exchange rate (NER) increases export growth (X) by 2.966 units. Additionally, the U.S GDP growth (RGDPf) is also positively related to export (X) growth in Liberia. A unit increase in the GDP growth rate of U.S increases Liberia's export growth (X) by 11.183 units. This is due to the huge trade transactions between the two economies, with United States being one of Liberia major trading partners. Real exchange rate risks, measure as volatility, is positively related to export growth. A unit increase in volatility (Vol) increases export (X) earnings by 2.4%. In the long-run, nominal exchange rate (NER) and the foreign exchange intervention on the foreign

exchange market represented by the dummy (INT) are both positively related to export with statistical significant. U.S GDP per capita (RGDPf) and volatility (Vol) also have statistically significant values with an inverse relationship with export.

Import model results show that in the short-run nominal exchange rate (NER), terms of trade (ToT) and the dummy variable (shock) are significant in explaining import growth Liberia. The import model coefficient ECM (Cointeq (-1)) term of -0.915 indicates a speedy adjustment process of about 91 percent of the disequilibria of the previous year's shock adjust back to the long-run equilibrium in the current year. Nominal exchange rate (NER) and external shock (shock) are negatively related to import of Liberia. Additionally, real exchange rate (RER) and terms of trade (ToT) are inversely related to import with statistically significant values. There is also a long-run relationship among the variables. In the long-run, nominal exchange rate (NER), external shock to the Liberian economy (shock) and terms of trade (Trade) are all negatively related to import with statistically significant values. Monetary intervention in the foreign exchange market (INT) and gross domestic product (Liberia) have statistically significant values and are positively related to import of Liberia as shown in Table 4.7.

The results from the trade balance model indicate that in the short-run, trade balance of the previous period (TB), the U.S real gross domestic product (RGDPf), real gross domestic product (Liberia) (RGDPd), nominal exchange rate (NER), real exchange rate (RER) and external shock (shock) are all significant in explaining changes in the trade balance of Liberia. The coefficient term of the Trade balance model, ECM (Cointeq (-1)) of -0.849, describes a quick adjustment process of approximately 84 percent of the disequilibria of the previous year's shock adjust back to the long-run equilibrium in the current year. Domestic GDP, nominal exchange rate (NER) and foreign GDP are positively related to trade balance (TB) with statistical significant values. However, real exchange rate (RER), terms of trade (ToT) and external shock (shock) are inversely related to trade balance. Table 4.6 provides the coefficients and probability statistics for all the variables in the trade model.

The autoregressive distributed lag (ARDL) model introduced by Pesaran and Shin and later advanced by Pesaran *et al.,* (2001) was adopted in this study to determine the effect of foreign exchange and real exchange rate on foreign trade in Liberia. This study confirms that there is exist short-run and long-run relationship between nominal exchange rate, real exchange rate, export, import and trade balance. The results further show a long-run statistically significant positive relationships between nominal exchange rate and export, real

gross domestic product of U.S and export, terms of trade and export, and central bank (intervention) and export. The results also indicate that there is a short-run and long-run statistically significant positive relationship between real exchange rate and import and terms of trade and import. Conversely, nominal exchange rate is inversely related to import of Liberia in both the short-run and long-run. Terms of trade tends to adjust in the long-run to a negative value and at the same time domestic GDP seems to contribute positively towards import growth of Liberia. Additionally, the results show that there exist short-run and long-run relationship between real gross domestic product (foreign) and trade balance, real gross domestic product (domestic) and trade balance, nominal exchange rate and trade balance, and real exchange rate and trade balance. Nominal exchange rate and terms of trade have a statistically significant positive relationship with trade balance. Real exchange rate has a statistically significant inverse relationship with trade balance in both the short-run and lung-run.

Based on the results of this study, the researcher would like to make the following recommendations: Promotion of Value Added Production and Trade Activities: There is a need for the introduction of trade policies geared towards the promotion of value added production and improvement in manufacturing and industrial sectors as a mean of providing income, employment and subsequently resulting to appreciation of the local currency and improving terms of trade and trade balance. “Fiscal” De-dollarization of the Liberian Economy: The dual currency and high dollarization seems to be putting huge pressure on the local currency as the demand for U.S dollar continue to increase. Fiscal policies—taxes and revenues—must support the current de-dollarization process if a tangible result is to be achieved. By initially quoting prices, taxes, and other business-related costs in Liberian dollar and also making government payments in Liberian dollar, the de-dollarization process will be fully realized and quickly achieved. This may allow policymakers to implement proper monetary policy gear towards achieving the overall economic goal of Liberia. Promotion of Financial Inclusion: The lack of the availability of commercial bank branches in many parts of the country reduces people’s chances of assessing various bank services including holding bank accounts, borrowing and investing. Thus, rendering the economy to be more informal. The need to promote financial inclusion in various forms that will allow for the availability of funds to businesses as a mean of investment in entrepreneur activities that will lead to strengthening the economy cannot be overemphasized. Establishment of an Institution for the Collection and Recording of Reliable Data for Policy Research: The unavailability of credible data for most

macroeconomic indicators makes research that could provide policy options for implementation difficult to carryout. The government needs to ensure the regular collection of key macroeconomic data for the ease of doing research geared towards policy recommendation.

**References**

Akan, Y., and Arslan, I. (2008). The Impact of Exchange-Rate Policies on the Foreign Trade: The Case of Turkey. *International Journal of Emerging and Transition Economies*, Vol. 1, Issue 2, 257-256.

Akhtar, M., and Spence, R. H. (1984). Effect of Exchange Rate Uncertainty on German and U.S Trade. *Federal Reserve Bank of New York Quarterly Review*, Vol. 9, 7-16.

Alvarez-Plata, P., and García-Herrero, A. (2008). *To Dollarize or De-dollarize: Consequence for Monetary Policy.* Berlin: German Institute for Economic Research (DIW) and BBVA, Working Paper.

Aristotelous, K. (2001). Exchange-Rate Volatility, Exchnage-Rate Regime, and Trade Volume: Evidence from the UK-US Export Function (1989-1999). *Economics Letters*, 72, 87-94.

Arize, A. C., Osang, T., and Slottji, D. J. (2000). Exchange-Rate Volatility and Foreign Trade: Evidence From Thirteen LDC's. *Journal of Business and Economic Statistics*, 18:1, 10-17.

Bailey, M.J., Tavlas, G.S., and Ulan, M. (1987). The Impact of Exchange-rate Volatility on Export Growth: some theoretical Considerations and Empirical Results. *Journal of Policy Modeling*, 9, 225-243.

Bakhromov, N. (2011). The Exchange Rate Volatility and the Trade Balance: Case of Uzbekistan. *Journal of Applied Economics and Business Research, JAEBR*, 1(3): 149-161.

Bank, W. (2015). *World Bank* . www.worldbank.org adresinden alındı

Broda, C., and Romalis, J. (2003). *Identifying the Relationship Between Trade and Exchange Rate Volatility.* Federal Reserve Bank of New York and University of Chicago.

CBL. (2005). *Central Bank of Liberia Annual Report.* Monrovia: Central Bank of Liberia.

CBL. (2016, December 8). *Central Bank of Liberia*. Central Bank of Liberia Microfinance: https://cbl.org.lr/2content.php?sub=218&related=32&third=218&pg=sp&pt=Rural%20Community%20Finance%20Institutions adresinden alındı

Chowdhury, A. R. (1993). Model, Does Exchange Rate Volatility Depress Trade? Evidence From Error-Correction. *Review of Economics and Statistics*, 75, 700-706.

Clark, P. Tamirisa, N. Wei, S. Sadikov, A. and Zeng, L. (2004). Exchange Rate Volatility and Trade Flow-Some New Evidence. *International Monetary Fund (IMF)*.

Danladi, J. D., Akomolafe, K. J., Babalola, O., and Akpan, E. A. (2015). Exchange Rate Volatility and International Trade in Nigeria. *Research Journal of Finance and Accounting*, Vol. 6 No: 18.

De Grauwe, P. (1988). Exchange Rate Variability and the Slowdown in Growth of International Trade. *Staff Papers, International Monetary Fund (IMF)*, s. Vol. 35, No.1 pp. 63-84.

Doganlar, M. (2002). Estimating the Impact of Exchange Rate Volatility on Exports: Evidence from Asian Countries. *Applied Economics Letters*, 9:13, 859-863.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276.

Gardner, L. A. (2012). The Rise and Fall of Sterling in Liberia, 1847-1943. *Unpublished*.

Greene, W. H. (2008). The econometric approach to efficiency analysis. *The measurement of productive efficiency and productivity growth*, 1, 92-250.

Grigoryan, G. (2015). The J-Curve Effect on the Trade Balance in Armenia. *International Journal of Economics, Finance and Management Sciences*, Vol. 3, No. 3, pp. 270-278.

Gupta, S., Pattillo, C., and Wagh, S. (2007). Making Remittances Work for Africa. *Finance and Development*, 44(2), 1-8.

Hayakawa, K., and Kimura, F. (2008). The Effect of Exchange Rate Volatility on International Trade in East Asia. *ERIA Discussion Paper Series*, 03.

IMF. (2006, July 31). *Data and Statistics*. IMF website: https://www.imf.org/external/np/mfd/er/2006/eng/0706.htm adresinden alındı

Johansen, S. (1988). Statistical Analysis of Cointegrating Vectors. *Journal of Economic Dynamics and Control*, 12, 231-254.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica: Journal of the Econometric Society*, 1551-1580.

Johansen, S. (1995). Identifying restrictions of linear equations with applications to simultaneous equations and cointegration. *Journal of econometrics*, 69(1), 111-132.

Johansen, S., and Juselius, I. (1990). Maximum Likelihood Estimation and Inference on Cointegration-With Applications to Demand for Demand. *Oxford Bulletin of Econornics and Statistics*, 52, 169-2 10.

Koray, F. a. (1989). Real Exchange Rate Volatility and U.S. Bilateral Trade: A VAR Approach. *Review of Econornics and Statistics,* , 71, 708-712.

Koray, F. K., Lastrapes, W. D. (1989). Real Exchange Rate Volatility and U. S. Bilateral Trade: VAR Approach. *Review of Economics and Statistics*, 71 (4), pp.708-712.

Krugman, P. R., and Obstfeld, M. (2006). *International Economics: Theory and Policy.* Boston: Pearson Addison-Wesley.

Krugman, P. R., Obstfeld, M., and Melitz, M. J. (1996). *International Economics.* Boston: Pearson Addison-Wesley.

Kumar, R., and Dhawan, R. (1991). Exchange Rate Volatility and Pakistani's Exports to the Developed World, 1974-1985. *World Development*, 19: 1225-1240.

McKenzie, M. D. (1999). The Impact of Exchange Rate Volatility on International Trade Flows. *Journal of Economic Surveys*, Vol. 13, No. 1, 706-106.

MoCI. (2013). *Ministry of Commerce and Industry* . Exports: http://www.moci.gov.lr/2content.php?sub=74&related=18&third=74&pg=sp adresinden alındı

Mundaca, B. G. (2001). Central bank interventions and exchnage rate band regimes. *Journal of International Money and Finance*, 20(5), 677-700.

Odili, O. (2015). Real Exchange Rate Volatility, Economic Growth and International Trade in an Emerging Market Economy: Evidence from Nigeria. *International Journal of Academic Research in Business and Social Sciences*, Vol.5, No.7.

Olimov, U., and Sirajiddinov, N. (2008). The Effect of the Real Exchange Rate Volatility and Misalignments on Foreign Trade Flows in Uzbekistan. *The Open-Access, Open-Asssement E-Journal*, 29.

Papaioannou, M. (2006). *Exchange Rate Risk and Management: Issues and Approaches.* IMF Working Paper.

Peree, E., and Steinherr, A. (1989). Exchange Rate Uncertainty and Foreign Trade. *European Economic Review*, 33, 1241--64 .

Pesaran, M. H., & Pesaran, B. (1997). Working with microfit 4.0. *Camfit Data Ltd, Cambridge.*

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16(3), 289-326.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association,*, 94(446), 621-634.

Phillips, P. C., & Perron, P. ( 1988). Testing for a unit root in time series regression. *Biometrika*, 335-346.

Rahutami, A. I. (2013). Real Exchange Rate Volatility and International Trade: ASEAN Experience towards ASEAN Economic Community.

ReSAKSS. (2015, July). *Regional Strategic Analytic and Knowledge Support System*. ReSAKSS: http://www.resakss.org/region/monitoring-progress/liberia adresinden alındı

Serenis, D., and Serenis, P. (2008). The Impact of Exchange Rate Volatility on Export: Evidence Four European Countries. *In International Conference on Applied Economics--ICOAE*, (s. p. 835-937).

Simakova, J. (2013). Estimation of the J-curve effect in the bilateral trade of Hungary. *Central European Review of Economic Issues*, Volume 16: 183-191.

Tarawelie, A. B., Sissoho, M., Conte, M., and Ahortor, C. R. (2012). Exchange Rate, Inflation and Macroeconomic Performance in the West African Monetary Zone (WAMZ). *WAMI Occasional Paper Series* , No. 2.

Vergil, H. (2000). Exchange Rate Volatility in Turkey and its Effect on Trade Flows. *Journal of Economic and Social research*, 4(1), 83-99.

WorldBank. (2015, October 25). *World Bank Website*. Countries Context: http://www.worldbank.org/en/country/liberia/overview adresinden alındı

WorldBank. (2016, April 13). *News*. World Bank website: http://www.worldbank.org/en/news/press-release/2016/04/13/remittances-to-developing-countries-edge-up-slightly-in-2015 adresinden alındı

WorldBank. (2016, October 2). *World Bank Topic*. World Bank: http://www.worldbank.org/en/topic/financialinclusion/overview adresinden alındı

Yeun-Ling, N., Wai-Mun, H., and Geii-Mei, T. (2009). Real Exchange Rate and Trade Balance Relationship: An Empirical Study on Malaysia. *International Journal of Business and Management*, Vol. 3, No. 8.

## Appendices

**Appendix 1.** *ARDL Cointegration Results for Export Model*

| Panel I: Short-run output results | Dependent Variable: $lnX_t$ | |
|---|---|---|
| Regressors | ARDL (1,1,0,0,0,1,2,2) | |
| $\Delta lnRGDP_{f_t}$ | 11.183 | (0.000)* |
| $\Delta lnNER_t$ | 2.966 | (0.000)* |
| $\Delta lnRER_t$ | 0.628 | (0.305) |
| $\Delta lnToT_t$ | 0.304 | (0.018)* |
| $\Delta Shock_t$ | 0.125 | (0.332) |
| $\int \text{¿}_t$ $\Delta \text{¿}$ | -0.343 | (0.346) |
| $\Delta INT_{t-1}$ | 5.039 | (0.000)* |
| $\Delta Vol_t$ | 0.024 | (0.073)** |
| $\Delta Vol_{t-1}$ | 0.025 | (0.008)* |
| $ECM_{t-1}$ | -0.641 | (0.000)* |
| Adjusted R-Squared | | (0.767) |
| F-statistics | | (8.528) |
| Durbin Watson-statistics | | (2.407) |
| Residual Sum of Squared | | (2.214) |

| Panel II: Long-run output results | Dependent Variable: $lnX_t$ | |
|---|---|---|
| $lnRGDP_{f_t}$ | -4.359 | (0.002)* |
| $lnNER_t$ | 4.798 | (0.002)* |
| $lnRER_t$ | 0.965 | (0.264) |
| $lnToT_t$ | 0.442 | (0.163) |
| $Shock_t$ | -0.549 | (0.181) |
| $\int_{¿}^{¿_t}$ | 3.788 | (0.007)* |
| $Vol_t$ | -0.026 | (0.334) |
| Constant | 36.454 | (0.001)* |

Note: Values marked with one and two astericks connotes 1% and 5% significance level respectively. Cointeq= $lnX$ - (-4.3599* ln RGDPF + 4.7978* $lnNER$ + 0.9658* $lnRER$ + 0.4424* $lnToT$ - 0.5494*Shock + 3.7884*INT - 0.0269*Vol + 36.4545

The results for the three models estimated show that the cointegration equation (ECM) is both significant and negative thus signaling that there exist short-run relationships amongst the variables in various models. For the export model, the results indicate that in the short-run that nominal exchange, terms of trade, intervention (monetary), exchange rate volatility and U.S GDP are significant in explaining growth in export of Liberia. The export model coefficient of ECM (Cointeq (-1)) term of -0.641 suggests a swift adjustment of approximately 64 percent of disequilibria in the previous year's shock adjust back to the long-run equilibrium level in the current year. As displayed by Table 4.4, nominal exchange rate (NER) appreciation has a positive relationship with export (X) growth. A unit increase in nominal exchange rate (NER) increases export growth (X) by 2.966 units. Additionally, the U.S GDP growth (RGDPf) is also positively related to export (X) growth in Liberia. A unit increase in the GDP growth rate of U.S increases Liberia's export growth (X) by 11.183 units. This is due to the huge trade transactions between the two economies, with United States being one of Liberia major trading partners. Real exchange rate risks, measure as volatility, is positively related to export growth. A unit increase in volatility (Vol) increases export (X) earnings by 2.4%. In the long-run, nominal exchange rate (NER) and the foreign exchange intervention on the foreign exchange market represented by the dummy (INT) are both positively related to export with statistical significant. U.S GDP per capita (RGDPf) and volatility (Vol) also have statistically significant values with an inverse relationship with export.

**Appendix 2.** *ARDL Cointegration Results for Import Model*

| Panel I: short-run output result | Dependent Variable: $lnIM_t$ |
|---|---|

| Regressors | ARDL | (2,1,2,2,2,1,2,1,0) |
|---|---|---|
| $\Delta lnIM_{t-1}$ | -0.344 | (0.010)* |
| $\Delta lnRGDP_{d_t}$ | 0.080 | (0.703) |
| $\Delta lnNER_t$ | -3.515 | (0.000)* |
| $\Delta lnNER_{t-1}$ | -2.707 | (0.000)* |
| $\Delta lnRER_t$ | 3.856 | (0.000)* |
| $\Delta lnRER_{t-1}$ | 3.080 | (0.000)* |
| $\Delta lnToT_t$ | 0.241 | (0.004)* |
| $\Delta lnToT_{t-1}$ | 0.412 | (0.000)* |
| $\Delta FDI_t$ | -0.000 | (0.726) |
| $\Delta Shock_t$ | -0.251 | (0.009)* |
| $\Delta INT_t$ | 0.145 | (0.455) |
| $\Delta Vol_t$ | 0.006 | (0.389) |
| $ECM_{t-1}$ | -0.915 | (0.000)* |
| Adjusted R-squared | | (0.966) |
| F-statistics | | (46.343) |
| Durbin Watson-statistics | | (2.684) |
| Residual Sum of Squared | | (0.473) |
| Panel II: long-run output results | Dependent Variable: $lnIM_t$ | |
| $lnNER_t$ | -1.292 | (0.020)* |
| $lnRER_t$ | 0.637 | (0.355) |
| $lnRGDP_{d_t}$ | 1.066 | (0.000)* |
| $lnToT_t$ | -0.345 | (0.000)* |
| $FDI_t$ | -0.000 | (0.220) |
| $Shock_t$ | -1.298 | (0.001)* |
| $\int_{¿}^{¿} ¿_t$ | 2.376 | (0.000)* |
| $Vol_t$ | 0.007 | (0.462) |
| Constant | 17.268 | (0.000)* |

**Source:** *Author's Computation, 2017*

Note: Figures marked with one and two astericks denotes significance level at 1% and 5% respectively. Cointeq = logImport – (1.0665*LogRGDPd – 1.2923*LogNER + 0.6379*LogRER – 0.3453*logToT – 0.0000*FDI -1.2923*Shock + 2.3763*INT + 0.0079*Vol +17.2686)

For the import model, the results show that in the short-run nominal exchange rate (NER), terms of trade (ToT) and the dummy variable (shock) are significant in explaining import growth Liberia. The import model coefficient ECM (Cointeq (-1)) term of -0.915 indicates a speedy adjustment process of about 91 percent of the disequilibria of the previous year's shock adjust back to the long-run equilibrium in the current year. Nominal exchange rate (NER) and external shock (shock) are negatively related to import of Liberia. Additionally, real exchange rate (RER) and terms of trade (ToT) are inversely related to import with statistically significant values. There is also a long-run relationship among the variables. In the long-run, nominal exchange rate (NER), external shock to the Liberian economy (shock) and terms of trade (Trade) are all negatively related to import with statistically significant values. Monetary intervention in the foreign exchange market (INT) and gross domestic product (Liberia) have statistically significant values and are positively related to import of Liberia

**Table 4.8** *ARDL Cointegration Results for Trade Balance Model*

| Panel I: short-run output result Dependent Variable: $\Delta lnTB_t$ | | |
|---|---|---|
| Regressors | ARDL | (3,2,2,2,2,1,2, 1,1) |
| $\Delta lnTB_{t-1}$ | 0.138 | (0.147) |
| $\Delta lnTB_{t-2}$ | 0.384 | (0.002)* |
| $\Delta lnRGDP_{d_t}$ | 0.056 | (0.823) |
| $\Delta lnRGDP_{d_{t-1}}$ | 2.967 | (0.000)* |
| $\Delta lnRGDP_{f_t}$ | 3.108 | (0.143) |
| $\Delta lnRGDP_{f_{t-1}}$ | 12.151 | (0.000)* |
| $lnNER_t$ | 1.307 | (0.017)* |
| $\Delta lnNER_{t-1}$ | 1.882 | (0.001)* |
| $\Delta lnRER_t$ | -1.396 | (0.006)* |
| $\Delta lnRER_{t-1}$ | -2.239 | (0.000)* |
| $\Delta lnToT_t$ | -0.040 | (0.641) |
| $\Delta Shock_t$ | 0.0258 | (0.769) |
| $\Delta Shock_{t-1}$ | -0.177 | (0.067)** |
| $\Delta INT_t$ | -0432 | (0.104) |
| $\Delta Vol_t$ | 0.0108 | (0.228) |
| $ECM_{t-1}$ | -0.849 | (0.000)* |
| Adjusted R squared | | (0.887) |
| F-statistics | | (11.532) |
| Durbin Watson- statistics | | (2.752) |
| Residual Sum of Squared | | (0.488) |
| Panel II: long-run output result Dependent Variable: $lnTB_t$ | | |
| $lnRGDP_{d_t}$ | -0.673 | (0.138) |
| $lnRGDP_{f_t}$ | 0.866 | (0.389) |
| $lnNER_t$ | 2.917 | (0.064)** |
| $lnRER_t$ | -2.024 | (0.042)* |
| $lnToT_t$ | 0.619 | (0.068)** |
| $Shock_t$ | 0.682 | (0.166) |
| $\int_{¿}^{¿} ¿_t$ | -3.192 | (0.039)* |
| $Vol_t$ | 0.049 | (0.103) |
| constant | -11.438 | (0.274) |

**Source:** *Authors' Computation, 2017*

Note: Numbers marked with one and two asterick denotes 1% and 5% significance level respectively. Cointeq = LogTB –(-0.6735*LogRGDPd + 0.8660*LogRGDPf + 2.9179*LogNER -2.0245*LogRER + 0.6191*LogToT + 0.6829*Shock -3.1926*INT + 0.0492*Vol – 11.4382)

The results from the trade balance model indicate that in the short-run, trade balance of the previous period (TB), the U.S real gross domestic product (RGDPf), real gross domestic product (Liberia) (RGDPd), nominal exchange rate (NER), real exchange rate (RER) and

external shock (shock) are all significant in explaining changes in the trade balance of Liberia. The coefficient term of the Trade balance model, ECM (Cointeq (-1)) of -0.849, describes a quick adjustment process of approximately 84 percent of the disequilibria of the previous year's shock adjust back to the long-run equilibrium in the current year. Domestic GDP, nominal exchange rate (NER) and foreign GDP are positively related to trade balance (TB) with statistical significant values. However, real exchange rate (RER), terms of trade (ToT) and external shock (shock) are inversely related to trade balance.