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AN INVESTIGATION OF TAX BUOYANCY AND ECONOMIC GROWTH NEXUS IN SIERRA LEONE

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Abstract: The study has empirically investigated the effect of tax buoyancy on economic growth in Sierra Leone using annual data from 1980 to 2020. Unit root test was conducted, accounting for structural breaks in the data. Different tax buoyancy measures were estimated using total tax revenue, import and private consumption. The ordinary least squares technique was adopted within the framework of the autoregressive distributed lag model. The results indicate that the buoyancy of tax revenue with respect to private consumption, which is the component that measures GST, is considered the highest, compared to the buoyancy of import, which is the component that measures customs and excise duties. Hence, based on the outcome of this revelation, it is recommended that government should focus more attention on increasing the tax base for goods and services tax instead of increasing tax base for customs and excise duties.

Keywords: ARDL, Economic Growth, Private Consumption, Tax Buoyancy

JEL Classification: C52, F43, E21, H21

I. INTRODUCTION

There is a general consensus among policymakers and academics that an effective tax system is a prerequisite to enhancing robust revenue mobilization in most least developing economies (LDCs). However, building an effective tax system

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tends to cause some structural bottlenecks that may impede the achievement of this goal. This has implication for macroeconomic policy stabilization. Especially when taxation is one of the sources of government revenue that is used to finance government activities without necessarily resorting to borrowing. However, most least developing countries have tried over the last four decades to promote economic growth using robust public expenditure as a conduit (Dudine and Jalles, 2017). The objective of this approach is to mobilize enough revenue to maintain the balance of payments deficits. This requires understanding the fundamental questions that are usually asked, such as the strength of tax buoyancy for the types of revenue mobilized, the direction of tax buoyancy during specific periods in the business cycle and the structural barriers that militate against an economy in determining its tax buoyancy. Hence, LDCs that have tried to propel economic growth by increasing public spending through taxation have been unable to match this spending spree with the required revenue mobilization (Twerefou et al., 2010). Tax buoyancy in this case measures the response of total tax revenue to changes in the growth of the economy. In other words, tax buoyancy puts emphasis on increases in the collectability of the tax on income, profit and consumption (Tanchev and Todorov, 2019).

Theoretically, economic instability tends to increase deficit financing through external debts. High external debts, however, affect domestic interest rates, balance of payments and depreciation in the domestic exchange rate. Also, efforts to obtain optimal fiscal policies via taxation have remained futile. This has implications for both fiscal and monetary policy implementation, as countries that cannot match their expenditure with the required revenue mobilization have the risk of not being able to drive their economies with robust policies (Kargbo and Egwaikhide, 2012). The Sierra Leone tax system is still underdeveloped despite several reforms undertaken over the past two decades. The country's tax administration system has been largely based on arbitrary and coercion across all local governments in the country. Corruption is still pervasive with growing formal and informal privileges in the form of tax exemptions granted to the elite population in the country at the expense of the country's revenue authority to mobilize the needed revenue to finance its development plans. This act of rent seeking, and corruption means that the citizens do not have confidence in the tax administration system and perceive tax collection as exploitative in the country and thus sometimes renege on the payment of taxes. This has implications for enhanced revenue mobilization. As this development creates persistent decline in revenue as percentage of GDP. On the basis of the foregoing, this study seeks to investigate the effect of tax buoyancy on economic growth, import and private consumption in Sierra Leone using annual data from 1980 to 2020. The contributes to the existing literature by estimating difference tax buoyancies for Sierra Leone by accounting

for structural breaks (both single and double breaks) that normally affect the robustness of most regression estimates that do not account for structural breaks in the data.

The rest of the study is organized as follows. Section two presents overview of the tax system in Sierra Leone. Section three reviews related literature, while Section four discusses theoretical framework, methodology and data. Section five presents and discusses empirical results of the study and Section six concludes and proffers policy recommendations.

II. OVERVIEW OF THE SIERRA LEONE TAX SYSTEM

The Sierra Leone tax system started during the period when the country was under colonial rule by the British prior to independence. During this period, the country and her colonial master went into an agreement called the UK/Sierra Leone double taxation agreement that was signed on December 19, 1947; amended by an agreement that was signed on March 18, 1968, and entered into force on February 16, 1948. Various categories of taxes were identified in this agreement including the surtax that came into effect effective April 6, 1945, income tax effective April 6, 1946, and profits tax from January 1, 1947. At the peak of this agreement was an arrangement for the avoidance of double taxation and the prohibition of fiscal evasion with respect to taxes on income. Taxes that were subject to this agreement included income tax (including surtax) and the profits tax (United Kingdom tax) that were levied in the UK and the income tax, the duty on profits charged under the Concessions Ordinance of 1931, the diamond industry profit tax, and the profits tax charged under the Tonkolili Ordinance agreement of 1937 that were levied in Sierra Leone. Once this agreement came into force, the agreement also applied to other taxes of a substantially similar feature imposed in the UK or Sierra Leone. These taxes remained in existence throughout the country's post-independence era until the outbreak of the civil unrest in the 1990s that lasted for a decade.

However, with the end of the civil unrest in 2002, the country engaged in several intuitional reforms, among which were the National Revenue Authority (NRA), National Social Security and Insurance Trust (NASSIT), etc. The NRA was charged with the exclusive right of mobilizing revenue for the government. To help achieve its mandate and propel optimal revenue mobilization, a series reform measures were undertaken by the NRA. For instance, the authority implemented the Integrated Tax Administration System (ITAS) for automation and integration of domestic tax revenue. The Customs Electronic Single Window (CESW) was also implemented for processing, approving and clearance of duty waiver goods. The authority also implemented an electronic fiscal device system for the administration of goods and services tax (GST) in 2010. The commencement of a

block management system for enhancing the compliance of small, medium and micro taxpayers was also enforced. The NRA also introduced the Domestic Tax Preparer Scheme (DTPS) to help improve compliance among Small and Medium Enterprises (SMEs). Moreover, the aforementioned reform measures were followed by progress made towards enhancing domestic revenue mobilization. Some of the progress made included the rolling out of the Automated System for Customs Data (ASYCUDA) world at the Queen Elizabeth II Quay at the Kissy Terminal, which is a computerized customs management system that covers most foreign trade procedures. The rollout of the ASYCUDA enabled the authority to capture transactions of the Oil Marketing Companies (OMCs), the Freetown International Airport (FIA) and the Guinea land border. Another piece of progress made so far is the introduction of Saturday Customs Operations (SCOs) to enable the construction and operationalization of in-house banking systems at the customs during the weekends. The authority also embarked on enhanced Taxpayer Education and Sensitization (TES) through the weekly televised NRA-Hour, introduction of a half-yearly newsletter, development of comprehensive tax guide and taxpayer workshops. The authority has also strengthened collaboration with revenue collecting Ministries, Departments and Agencies (MDAs), as well as the Treasury Single Account (TSA) aimed at consolidating non-tax revenue performance.

III. EMPIRICAL LITERATURE

Empirically, several studies have examined the effect of tax buoyancy on economic growth ranging from developed economies to least developing economies. These studies adopted various measures of tax buoyancy to unravel the long-run and short-run effect of tax buoyancy on economic growth. Osoro (1993) estimated tax buoyancy using double log equation and tax revenue elasticity using the proportional adjustment method for Tanzania for the period 1979 to 1989. The result found an overall tax elasticity of 0.76 and a tax buoyancy of 1.06. These results were attributed to the granting of more tax exemptions by the government and poor tax administration system. Ariyo (1997) followed Osoro's (1993) method by evaluating the productivity level of the tax system in Nigeria for the period 1970 to 1990. The result found an overall satisfactory tax production level but with huge variation in the level of tax revenue by various tax sources owing to laxity in the administration of non-oil tax sources during the oil boom periods.

Chipeta (1998) found a tax buoyancy coefficient of 0.95 and tax elasticity coefficient of 0.6 and concluded that tax bases outweigh gross domestic product. Chaudhry (2001) investigated optimal tax theory to devise an appropriate tax policy system for the agricultural sector in Pakistan and found that an optimal tax policy generates tax buoyancy rates to be high and statistically significant at

the 1% level. Muriithi and Moyi (2003) found a positive impact on the overall tax structure for Kenya, while individual tax handles except value added tax (VAT) failed to respond to changes in income. Bilquees (2004) also found tax elasticity and buoyancy of less than one in Pakistan. Ayoki et al. (2005) investigated the effect of tax reforms on domestic revenue mobilization in Uganda using the proportional adjustment method. They found that reforms in the tax system had a positive impact on direct taxes as the tax-to-income elasticity index grew from 0.706 to 1.082 after the reforms, while indirect taxes moved from 1.037 to 1.306. Farooq (2006) found a significant tax buoyancy rate for GDP and volume of trade as tax bases for tax revenue when he estimated tax buoyancy coefficients for a number of variables in Pakistan using annual data from 1980 to 2004.

Similarly, using cointegration technique and error correction model, Yousuf and Huq (2013) found tax buoyancy coefficients to be higher than tax elasticity coefficients in Bangladesh. Omondi et al. (2014) used ordinary least square technique to investigate the effect of changes in tax policy on tax buoyancy and tax elasticity in Kenya for the period 1960 to 2010. Their results found an estimated tax buoyancy coefficient of 1.17. This result was attributable to the fact that tax revenue grew at a faster rate than economic growth. The result also revealed a bi-directional causality between tax revenue and economic growth, running from tax revenue to economic growth and vice versa. Using pooled OLS for some Least Developing Countries (LDCs), Ashrat and Sarwar (2016) found that corruption had distortionary effects on tax revenue collection, while tax buoyancy and tax elasticity were found to be higher in countries LDCs that practice democracy.

Jalles (2017) used fully modified ordinary least squares (FMOLS) technique and pooled mean group on panel data to from 1980 to 2014 to analyze tax buoyancy dynamics in low-income countries, emerging market economies and developed economies. Their results revealed that both short-run and long-run tax buoyancies for developed economies were the same, while corporate tax buoyancies in emerging market economies were found to be larger during periods of recession than during periods of economic boom. However, trade openness and human capital were found to increase tax buoyancy, while inflation and output volatility decrease tax buoyancy. Deli et al. (2018) found that tax revenue estimates were not different from one, while personal income tax buoyancies were small than unity in a sample of 25 developed economies from 1965 to 2015. Similarly, Lagravinese (2020) found both short-run and long-run buoyancies in OECD countries to be less than unity, a result that does not corroborate with earlier study by Deli et al. (2018)

Tanchev and Todorov (2019) used the fully modified least squares (FMOLS) and autoregressive distributed lag (ARDL) model to analyze long-run and short-run tax buoyancies of Bulgaria and their nexus with the Bulgarian economy. The

objective of the study was to determine the collectability of aggregate tax revenues and the revenues generated from different tax systems. Key variables included value added tax, personal income tax, corporate tax and social security contributions in Bulgaria. Quarterly data spanning from 1991 to 2017 was used in this study. They found that in the long run, the buoyancy of aggregate tax revenue was close to unity. However, in the short run, the buoyancy of aggregate revenue was substantially below unity. This means that they do not serve as an automatic stabilizer. They, therefore, recommended that taxes that are inefficient with less collectability of aggregate revenues should be reformed.

Farooq (2006) adopted the constant rate structure method to estimate tax buoyancy rates in Pakistan using annual data from 1980 to 2004 on volume of trade, broad money, gross domestic product (GDP), tax revenue, public debt, consumer price index (CPI) and gross investment. The results show long-run relationship among the variables. Gupta and Liu (2020) estimated both long-run and short-run tax buoyancy for forty-four Sub-Saharan Africa (SSA) countries during the period 1980 to 2017 using time series and panel data models. The study used the response of tax revenues to changes in national income to capture the effect of tax buoyancy. The results showed that government debt exerted a downward trend on tax buoyancy and tax systems in SSA countries cannot generate domestic revenues needed for financing sustainable development goals.

Twerefou et al. (2010) estimated the buoyancy and elasticity for the Ghanaian economy using the dummy variable approach to control for the effects of the discretionary tax system on historical time series for the period 1970 to 2007. Their results revealed that the overall Ghanaian tax system was buoyant and elastic in the long run with the degree of buoyancy greater that the elasticity. But in the short run, the degree of buoyancy was less than the elasticity. However, the overall tax system was found to be greater than unity, implying that the responsiveness of the tax system to a unit change in GDP was greater than unity. Hence, to enhance economic growth, they suggested that tax collections must be improved. Kokila (2022) used the ordinary least square (OLS) technique to analyze the effect of tax buoyancy on tax revenue and economic growth in India. Annual data covering 2001 to 2022 was used to estimate this relationship. The results revealed that improvement in technology enhanced tax compliance and thus propelled economic growth in India.

Musa et al. (2016) used the standard multiple regression in the form of the vector error correction (VEC) model to estimate the buoyancy and elasticity of tax in Nigeria. They realized that the buoyancy and elasticity of tax are key measures of the respond of tax revenue to income. The results showed that tax revenue is significantly buoyant and elastic in Nigeria. And recommended that the Nigeria authorities should introduce policies that enhance compliance in tax

collection, which ultimately engenders growth. This result was preceded by the study by Upender (2008), who estimated the degree of tax buoyancy in India using the double-log regression model with an interactive term. Annual data from 1951 to 2005 was used. Results showed that constant gross tax buoyancy was positive and significant but greater than unity. The interactive term was also significant and negative, suggesting a downward trend in the degree of tax buoyancy. Ratio of gross tax revenue to GDP increased with an increase in economic growth.

IV. THEORETICAL FRAMEWORK, METHODOLOGY AND DATA

The theoretical framework of this study is built on the spirit of Chelliah (1971) who posits that tax efforts to a large extent is determined within the dynamic of changes in the tax ratio overtime. He argued that countries that exert little effort in mobilizing tax revenue at any point in time are constrained in harnessing the desired tax revenue. In other words, countries with low proportion of taxes can only succeed in increasing their tax ratios without necessarily achieving the optimal tax level. To him, tax effort is a process that consists of reforms in the existing tax laws and administration that are geared towards expanding the tax base to generate more tax revenue. Hence, it is expected that the income tax buoyancy of total tax revenue can provide the required information on the previous effort applied to increase tax revenue. He presented the short-run and long-run tax revenue functions in the spirit of some dynamic concepts as follows. The long-run buoyancy and elasticity of tax revenue is presented in the form of a Cobb-Douglas production function in nonlinear form as.

$$TTRV_t^{LR} = \alpha_0 RGDP_t^{\alpha_1} \tag{1}$$

where TTRV is long-run actual tax revenue, RGDP is real gross domestic product that measures the base to achieve responsiveness in actual tax collection. α_0 is intercept of the equation while α_1 measures tax buoyancy coefficient. Equation (1) is transformed into a log-linear form as.

$$LNTTRV_t^{LR} = \alpha_0 + \alpha_1 LNNGDP_t \tag{2}$$

The elements in equation (2) are defined as before. However, the left-hand-side of equation (2) is unobservable, so equation (2) is estimated in the form of a partial adjustment model of the form.

$$\left\{\frac{TTRV_t}{TTRV_{t-1}}\right\} = \left\{\frac{TTRV_t^{LR}}{TTRV_{t-1}}\right\}^{\theta} \tag{3}$$

where $TTRV_t$ is current period tax revenue, $TTRV_{t-1}$ is previous period tax revenue. θ is partial speed of adjustment coefficient between desired and actual total tax revenue and is expected to lie between 0 and 1 with the following restrictions. When it is less than 1, implies actual changes in tax revenue is lower than desired changes in tax revenue; when it is greater than 1, implies actual changes in tax revenue is more than desired changes in tax revenue and finally, when it is equal to 1, implies actual changes in tax revenue is equal to desired changes in tax revenue. Equation (3) posits that lack of technological progress, habit formation, unconducive environment, resource and institutional constraints, further constrain the ability of revenue authorities, the NRA in the case of Sierra Leone, to adjust the actual volume of tax mobilization to its desired limit. Hence, equation (3) is log-linearized as.

$$LNTTRV_t - LNTTRV_{t-1} = \theta\left\{LNTTRV_t^{LR} - LNTTRV_{t-1}\right\} \tag{4}$$

Rearranging equation (4) gives.

$$LNTTRV_t = \theta\left\{LNTTRV_t^{LR} - LNTTRV_{t-1}\right\} + LNTTRV_{t-1} \tag{5}$$

Substituting equation (2) into equation (5) and further rearranging yields

$$LNTTRV_t = \theta\left\{\alpha_0 + \alpha_1 LNNGDP_t - LNTTRV_{t-1}\right\} + LNTTRV_{t-1} \tag{6}$$

Again, expanding equation (6) yields.

$$LNTTRV_t = \theta\alpha_0^{SR} + \theta\alpha_1^{SR} LNNGDP_t + \theta\alpha_2^{SR} LNTTRV - LNTTRV_{t-1} \tag{7}$$

where $\theta\alpha_0 = \alpha_0^{SR}$ is short-run intercept; $\theta\alpha_1 = \alpha_1^{SR}$ is short-run buoyancy coefficient and $1-\theta = \alpha_2^{SR}, \theta = 1-\alpha_2^{SR}$.

It is worth noting that the partial derivative LNTTRV with respect to LNGDP describes short-run tax buoyancy estimate. Thus, to derive the long-run estimate of tax buoyancy, we normalize the short-run tax buoyancy using the coefficient of our partial adjustment parameter (theta). In this regard, when the degree of the partial adjustment parameter is greater than unity, it implies we expect the growth rate of tax revenue to be greater than the growth rate of the economy, real GDP in this case. Corollary, if the degree of the partial adjustment parameter is less than unity, we expect the growth rate of tax revenue to be less than the growth rate of the economy. Finally, when the degree of the partial adjustment parameter is equal to unity, we expect the growth rate of tax revenue to be equal to the growth rate of the economy. Therefore, the dynamics of actual gross tax revenue to changes in

real GDP can be described in this case as the tax buoyancy of gross tax revenue. Presumably, we can now estimate gross tax buoyancy between two time periods in the spirits of Upender (2008) and Gupta, Jalles and Liu (2022) as.

$$BGTTRV_t = \left\{ \frac{\frac{GTTRV_t}{GTTRV_{t-1}} - 1}{\frac{NGDP_t}{NGDP_{t-1}} - 1} \right\} \tag{8}$$

Equation (8) depicts gross buoyancy of tax revenue between two points. Note that this equation is biased because the estimate is done between two points. To make it look like a robust estimate, we estimate the gross buoyancy of tax revenue based on average or mid-point buoyancy technique. This enables compute the annual buoyancy of actual gross tax revenue as.

$$Mid\_point\ BGTTRV_t = \left\{ \left(\frac{GTTRV_t}{GTTRV_{t-1}} - 1 \right) \times \frac{RGDP_t + RGDP_{t-1}}{GTTRV_t + GTTRV_{t-1}} \right\} \tag{9}$$

1. Specification of Econometric Model

Following derivation of the theoretical framework, we now formulate the econometric model to aid us estimate both long-run and short-run tax buoyancy model as.

$$LNTTRV_t = \alpha_{\tau 0} + \alpha_{\tau 1} LNNGDP_t + \mu_{\tau t} \tag{10}$$

where $\alpha_{\tau 0}, \alpha_{\tau 1}, \mu_{\tau t}$ denotes intercept of the components of tax revenue, buoyancies of the tax revenue and stochastic error term respectively. τ or tau is the components of tax revenue. Equation (10) is then augmented to arrive at our final econometric model to estimate the effect of tax buoyancy on economic growth in Sierra Leone as.

$$LNTTRV_t = \gamma_0 + \gamma_1 LNNGDP_t + \gamma_2 LNIMP_t + \gamma_3 LNPC_t + \varepsilon_t \tag{11}$$

Where TTRV is total tax revenue, NGDP is nominal GDP, IMP is total import and PC is private consumption.

The study uses annual data from 1980 to 2020 on total tax revenue, nominal GDP, total import and private consumption obtained from the World Bank's World Development Indicators database and International Finance Statistics. Total tax revenue is measured as total domestic tax revenue of the government which is used as overall tax revenue. Import is measured as total import, which is the base for customs and excise duties. Private consumption is measured as a base for sales and goods and services tax. GDP is measured as nominal GDP at constant prices.

2. Estimation Techniques

Time series data are normally engulfed with the problem of stationarity, which when not attended to may cause spurious or nonsense regression. Hence, it is widely believed that before modeling time series data, the first thing to do is to check for the absence of non-stationary series. Several tests have been applied in the extant literature to test for stationarity. Traditionally, the Dickey-Fuller class of test (Dickey-Fuller, Augmented Dickey-Fuller, Philips-Perron tests, etc.) have been generally used by several scholars. But these types of tests are accused of having low power in detecting stationarity in the midst of structural breaks in the data. This has led to the introduction of a battery of tests in exhuming the presence of non-stationarity in time series data. They are deemed to have more power and size in detecting unit roots in the data especially in the presence of structural breaks. Hence, the variables have been tested for stationarity because the application of OLS with nonstationary variables leads to spurious regression. Thus, the Dickey-Fuller GLS unit root test has been applied, as it has better size and power over the original Dickey-Fuller tests and other first-generation tests.

In addition, the Zivot and Andrews (1992) test, which accounts for only one structural break in the data; the Lumsdaine and Papell (1997) test, which extended the Zivot and Andrews technique by accounting for two structural breaks in the data have also been applied to tackle the problem of structural breaks in the data. However, these approaches however, failed to elaborate on the nature of the break in the data. Hence, Perron and Vogelsang (1992), Vogelsang and Perron (1998) and Clemente-Montanes-Reyes (1998) have been applied to surmount these challenges with the introduction of unit root test with single and double structural breaks in the data respectively.

The Perron and Vogelsang (1992) unit root test for single structural break and the Clemente-Montanes-Reyes (1998) unit root tests for double structural breaks have been explored in this study. The use of these structural break tests is to account for the fact that when a series has structural break(s), the Dickey-Fuller GLS tends to fail to reject the null hypothesis that there is unit root (the variable is nonstationary) even when the variable is stationary. The use of the CMR in conjunction with the PV is to account for the fact that when there is a double break, the PV tends to fail to reject the null hypothesis that there is unit root because it accounts for only one structural break in the data while the CMR accounts for double breaks. These tests are presented below in the following equations, depicting single structural break in trend and intercept and double structural breaks in trend and intercept.

$$\Delta y_t = \nu + \gamma y_{t-1} + \lambda t + \rho_1 dt_1 + \sum_{j=1}^{k} dj \Delta y_{t-j} + \eta_t \tag{12}$$

Equation (12) depicts unit root test with single structural break in trend, while equation (13) shows unit root test with single structural breaks in trend and intercept based on Zivot and Andrews (1992) single break test.

$$\Delta y_t = \nu + \gamma y_{t-1} + \lambda t + \psi_1 du_t + \rho_1 dt_1 + \sum_{j=1}^{k} dj \Delta y_{t-j} + \eta_t \tag{13}$$

Similarly, equation (14) shows unit root test with double structural breaks in trend, while equation (15) shows unit root test with two structural breaks in trend and intercept respectively.

$$\Delta y_t = \nu + \gamma y_{t-1} + \lambda t + \psi_1 du1_t + \psi_2 du2_t + \sum_{j=1}^{k} dj \Delta y_{t-j} + \eta_t \tag{14}$$

$$\Delta y_t = \nu + \gamma y_{t-1} + \lambda t + \psi_1 du1_t + \psi_2 du2_t + \rho_1 dt_1 + \sum_{j=1}^{k} dj \Delta y_{t-j} + \eta_t \tag{15}$$

Having established the stationarity status of the model variables, the next step is to ascertain whether the variables are co-integrated. This decision is strongly informed by the unit root test results. If all the variables are integrated of order zero or I (0), then the ordinary least squares techniques become the most appropriate. If all the variables are integrated of order one or I (1), then it is easy to apply the Johansen techniques. However, if the variables are of mixed order of integration, that is, some are integrated of order zero or I (0) and some are integrated of order one or I (1), then the autoregressive distributed lag (ARDL) approach becomes the ideal techniques, as long as none of the variable is integrated of an order higher than one. Hence, the ARDL representation of equation (11) is shown below.

$$\Delta LNTTRV_t = \chi_0 + \sum_{t=1}^{p} \chi_{1i} \Delta LNTTRV_{t-i} + \sum_{t=0}^{p} \chi_{2i} \Delta LNNGDP_{t-i} + \sum_{t=0}^{p} \chi_{3i} \Delta LNMPT_{t-i} + \sum_{t=0}^{p} \chi_{4i} \Delta PC_{t-i}$$
$$+ \omega_1 LNTTRV_{t-1} + \omega_2 LNNGDP_{t-1} + \omega_3 LNIMP_{t-1} + \omega_4 PC_{t-1} + \kappa_t \tag{16}$$

Equation (16) depicts both long-run and short-run components of the ARDL model, which is actually used to estimate the long-run and short-run relationship between tax buoyancy and economic growth in Sierra Leone.

V. PRESENTATION AND DISCUSSION OF RESULTS

1. Descriptive Statistics

We start with descriptive statistics of the model variables because it gives an early insight of the data set. This allows the researcher to have preliminary observations

of the data. Therefore, in carrying out any econometric analysis of time series data, it is highly advisable that researchers produce summary statistics of the data. Hence, Table 1 presents descriptive statistics of the data used in this study. The Table indicates that there are 41 observations of the data set, in which the mean, standard deviation, minimum and maximum observation of each variable is produced.

Table 1: Descriptive Statistics of Model Variables

Variable	*Observation*	*Mean*	*Std. Dev.*	*Minimum*	*Maximum*
Total Tax Revenue	41	19.8229	4.0563	13.9698	25.5444
Nominal GDP	41	29.3258	0.3524	28.8781	29.9998
Import	41	19.8854	1.0011	18.1138	21.7861
Private Consumption	41	4.5962	0.0984	4.3792	4.7889

Source: Author's Estimation

According to the Table, the average of total tax revenue during the study period is 19.82 with 13.97 as minimum value and 25.54 as maximum value. Mean nominal GDP is 29.33, while the minimum and maximum values are respectively 28.88 and 30.00. Similarly, the average import value is 19.89, with a minimum value of 18.11 and maximum value of 21.79. Finally, the average value of private consumption is 4.60, with minimum and maximum values of 4.38 and 4.79 respectively. However, based on the minimum and maximum GDP values, one might suspect some anomalies in the data, possibly due to structural breaks and other macroeconomic shocks. This will be taken care of by accounting for structural breaks in the data.

2. Correlation Matrix

Another preliminary assessment done on the data is correlation matrix, normally used in time series econometric analysis because it helps researchers avoid the problem of serial correlation in the data. Table 2 depicts correlation matrix of the

Table 2: Correlation Matrix of Model Variables

	Total Tax Revenue	*Real GDP*	*Import*	*Private Consumption*
Total Tax Revenue	1.0000			
Nominal GDP	-0.5730	1.0000		
Import	-0.4316	0.8938	1.0000	
Private Consumption	-0.0148	0.2635	0.4921	1.0000

Source: Author's Estimation

model variables. The Table presents a negative but moderate correlation among total tax revenue, nominal GDP, import and private consumption. There is however a positive but high correlation between nominal GDP and imports, as well as a positive but moderate correlation between nominal GDP and private consumption. The Table also presents a positive but moderate correlation between import and private consumption.

3. Dickey-Fuller Generalized Least Squares Unit Root Analysis of Model Variables

The Dickey-Fuller GLS unit root test is considered to be robust in identifying unit root in times series data. This is because it has high power in detecting unit root. Table 3 presents unit root test results of the model variables using the Dickey-Fuller GLS techniques. This test is conducted with deterministic constant and a lag period of one on each of the variables.

Table 3: Dickey-Fuller Generalized Least Squares Unit Root Test Results

Variable		*Deterministic Component*	*Lag*	*Test Statistics*	*Conclusion*
Total Tax Revenue	L	Constant	1	-1.184	I (K)
	1D	Constant	1	-1.162	
	2D	Constant	1	-1.126	
Nominal GDP	L	Constant	1	-0.999	I (K)
	1D	Constant	1	-0.920	
	2D	Constant	1	-0.931	
Import	L	Constant	1	-1.417	I (K)
	1D	Constant	1	-1.382	
	2D	Constant	1	-1.339	
Private Consumption	L	Constant	1	-2.591	I (K)
	1D	Constant	1	-2.542	
	2D	Constant	1	-2.492	
		Critical Values			
Constant			Constant and Trend		
1%:		-2.634	**1%:**		-3.770
5%:		-2.384	**5%:**		-3.314

Source: Author's Estimation

The Table shows that none of the variables are stationary after the second difference, implying possibly detection of structural breaks in the data that cannot be accounted for in the Dickey-GLS case. This necessitates accounting for structural breaks in the data using another technique.

4. Perron-Vogelsang Unit Root Analysis of Model Variables

Failure to detect unit root with structural breaks in the data necessitates accounting for these breaks using the Perron-Vogelsang technique. This technique accounts for a single break in the data with both immediate break (additive outlier) and gradual break (innovative outlier). The additive outlier indicates that structural breaks in the data are instantaneous, while innovative outlier indicates that structural breaks come with a lag. Table 4 presents unit root test results using the Perron- Vogelsang technique with both additive and innovative outliers. The Table shows that all the variables are stationary at level, except import, which is stationary after the first difference. However, it is sometimes possible that there are double breaks in the data which might not be accounted for using the Perron-Vogelsang technique.

Table 4: Perron-Vogelsang Single Break Unit Root Test Results

Additive Outlier (Immediate Break)					*Innovative Outlier (Gradual Break)*			
Variable		*Break Point*	*P-Value*	*Test Statistics*	*Break Point*	*P-Value*	*Test Statistics*	*Conclusion*
Total Tax Revenue	L	2012	0.000	-2.447	2009	0.000	-19.778	I (0)
	1D	2009	0.073	-1.300	-	-	-	
	2D	2009	0.992	-7.524	-	-	-	
Nominal GDP	L	2008	0.000	-2.751	2000	0.000	-5.417	I (0)
	1D	1999	0.017	-6.864	-	-	-	
Import	L	2007	0.000	-1.725	1998	0.001	-2.975	I (1)
	1D	1984	0.029	-3.182	1985	0.009	-7.629	
	2D	1998	0.944	-7.552	-	-	-	
Private Consumption	L	1985	0.000	-2.584	1993	0.002	-4.455	I (0)
	1D	2011	0.672	-5.757	-	-	-	
	2D	2011	0.768	-8.848	-	-	-	
5% Critical Values								
Additive Outlier:			-3.560		Innovative Outlier:			-4.270

Note: 1. L=Level, 1D=1st Difference and 2D=2nd Difference; 2. I (K)=Series not Stationary after 2nd Difference

5. Clemente-Montanes-Reyes Unit Root Analysis of Model Variables

Given that the Perron-Vogelsang technique might not detect unit root with double structural breaks in the data, it is prudent to also account for unit root with double breaks in the data using the Clemente-Montanes-Reyes double breaks technique. Table 5 (a) presents unit root results with double structural breaks in the data, which assumes the breaks to be instantaneous.

Table 5 (a): Clemente-Montanes-Reyes Double Breaks Unit Root Test Results

Panel A: Additive Outlier (Immediate Break) Results

		First Break		*Second Break*			
Variable		*Breakpoint*	*P-Value*	*Breakpoint*	*P-Value*	*Test-Statistics*	*Conclusion*
Total Tax Revenue	L	1990	0.000	2012	0.000	-3.606	I (K)
	1D	2008	0.000	2011	0.001	-1.512	
	2D	2009	0.973	2012	0.961	-4.489	
Nominal GDP	L	1999	0.073	2009	0.003	-0.031	I (K)
	1D	1999	0.017	2011′	0.432	-3.684	
	2D	1990	0.895	2013	0.484	-9.913	
Import	L	2001	0.000	2008	0.000	-2.562	I (K)
	1D	1984	0.067	1995	0.811	-2.855	
	2D	1995	0.874	1998	0.864	-3.825	
Private Consumption	L	1992	0.000	2010	0.206	-5.012	I (K)
	1D	1998	0.872	2011	0.657	-6.269	
	2D	2008	0.757	2011	0.675	-3.001	
	Additive Outlier 5% Critical Value:					-5.490	

Note: 1. L=Level, 1D=1st Difference and 2D=2nd Difference; 2. I (K)=Series not Stationary after 2nd Difference

According to the Table, all the variables are not stationary even after differencing each of them twice. We also perform unit root tests with innovative outlier or gradual break as shown in Table 5 (b). According to the Table, with innovative outlier, total tax revenue is stationary after second difference, while nominal GDP is stationary after first difference. However, both import and private consumption are not stationary even after the second difference.

Table 5 (b): Clemente-Montanes-Reyes Double Breaks Unit Root Test Results

Panel B: Innovative Outlier (Gradual Break) Results

		First Break		*Second Break*			
Variable		*Breakpoint*	*P-Value*	*Breakpoint*	*P-Value*	*Test-Statistics*	*Conclusion*
Total Tax Revenue	L	1989	-	2009	0.000	-19.778	I (2)
	1D	1986	0.061	2010	0.162	-39.240	
	2D	2010	0.000	2014	0.000	-41.090	
Nominal GDP	L	1990	-	2000	0.000	-5.417	I (1)
	1D	2000	0.000	2013	0.000	-9.974	

contd. table 5(b)

Variable		*First Break*		*Second Break*			
		Breakpoint	*P-Value*	*Breakpoint*	*P-Value*	*Test-Statistics*	*Conclusion*
Import	L	1998	0.001	2009	0.001	-3.886	I (K)
	1D	1985	0.880	1996	0.862	-5.599	
	2D	1986	0.940	1999	0.936	-8.315	
Private Consumption	L	1993	0.002	2011	0.110	-5.119	I (K)
	1D	1999	0.198	2012	0.399	-11.144	
	2D	1988	0546	2012	0.467	-9.346	
Innovative Outlier 5% Critical Value:						-5.490	

Note: 1. L=Level, 1D=1st Difference and 2D=2nd Difference; 2. I (K)=Series not Stationary after 2nd Difference

6. Combination of Unit Root Results from all three techniques

The decision on the stationarity status of the model variables from the three approaches presented and discussed above is based on the approach with the least order of integration of each of the variables. Table 6 presents combined unit root test results of these approaches.

Table 6: Combination of the Unit Root Test Results from all three approaches

Variable	*OI from DF_GLS*	*OI from PV*	*OI from CMR*	*Conclusion*
Total Tax Revenue	I (K)	I (0)	I (2)	I (0)
Real GDP	I (K)	I (0)	I (1)	I (0)
Import	I (K)	I (1)	I (K)	I (1)
Private Consumption	I (K)	I (0)	I (K)	I (0)

Note: 1. I (K) means series is not Stationary after first difference 2. OI means order of integration 3. DF_GLS means Dickey-Fuller GLS 4. PV means Perron-Vogelsang 5. CRM means Clemente-Montanes-Reyes

According to the Table, all the variables are stationary at level, except import, which is stationary after the first difference. This justifies the application of the ARDL techniques to cointegration.

7. Autoregressive Distributed Lag (ARDL) Model Estimates of Tax Buoyancy

The order of integration of the unit root test results justifies the application of the autoregressive distributed lag (ARDL) modeling technique within the framework of the ordinary least squares (OLS). Table 7 presents buoyancy of tax revenue results with respect to economic growth, import and private consumption. From

the Table, Panel A presents a baseline model in which an OLS regression model has been estimated with total tax revenue as the dependent variable and nominal GDP, import and private consumption as explanatory variables.

Table 7: Buoyancy of Tax Revenue to Economic Growth, Import and Private Consumption

Panel A: Regression of Tax Revenue Nominal GDP Import and Private Consumption				
Total Tax Revenue	*Coefficient*	*Standard Error*	*T*	*P>|t|*
Nominal GDP	-0.4720	0.2188	-2.16	0.040**
Import	0.8945	0.0715	12.50	0.000***
Private Consumption	-0.4138	0.3566	-1.16	0.256
Constant	14.8012	5.0010	2.96	0.006***
Panel B: Regression of Total Tax Revenue with respect to Nominal GDP				
Nominal GDP	1.2887	0.4045	3.19	0.003***
Constant	-8.8799	8.9932	-0.99	0.332
Panel C: Regression of Total Tax Revenue with respect to Import				
Import	0.7790	0.0445	17.49	0.000***
Constant	4.6538	0.8648	5.38	0.000***
Panel D: Regression of Total Tax Revenue with respect to Private Consumption				
Private Consumption	1.6136	0.8654	5.38	0.000***
Constant	12.3905	3.9593	3.13	0.004***

Source: Author's Estimation. Note: (***) and (**) denote significant at the 1% and 5% level

The results in Panel A posit a negative and significant relationship between total tax revenue and economic growth. This means that a 1% increase in nominal GDP reduces total tax revenue by 0.47%. This result is counter intuitive, as we expect a positive relationship between total tax revenue and economic growth. This warrants estimation of various buoyancies using total tax revenue as dependent variable with respect to nominal GDP, import and private consumption respectively in separate models and compares the various buoyancies.

Hence, in Panel B, we estimated buoyancy of total tax revenue with respect to economic activity, which is the base for overall tax revenue. When total tax revenue is the dependent variable and nominal GDP as the explanatory variable, we observe a positive and significant relationship between total tax revenue and economic growth at the 1% significant level. The result shows that an increase in economic growth by 1% increases total tax revenue by 1.29% at a 1% significant level.

Similarly, we estimated buoyancy of total tax revenue with respect to import, which is the base for customs and excise duties. The result is shown in Panel C with total tax revenue as dependent variable and import as explanatory variable. The result depicts a positive and significant relationship between total tax revenue and imports at the 1% significant level. The result shows that an increase in imports by 1% increases total tax revenue by 0.78%. Finally, we estimated buoyancy of total tax revenue with respect to private consumption, which is the base for goods and services tax (GST). The result is shown in Panel D with total tax revenue as the dependent variable and private consumption as the independent variable. The result shows that an increase in private consumption by 1% increases total tax revenue by 1.61%. These findings corroborate with Tanchev and Todorov (2019), who estimated buoyancies for aggregate tax revenue, revenue from value added tax, income tax, corporate tax and social security tax in Bulgaria using the fully modified ordinary least square technique.

Nonetheless, the buoyancy of total tax revenue from import is less than one, which is below economic growth, while the buoyancy of private consumption is greater than one, almost at per with economic growth. Implying that private consumption can serve as automatic stabilizer in propelling growth. Since robust private consumption, especially for middle income countries can attract taxes which promotes economic growth. Similarly, the coefficient of economic growth is greater than unity, implying taxes can actually act as automatic stabilizer in promoting economic growth.

XI. CONCLUSION AND POLICY RECOMMENDATIONS

The study has empirically examined the relationship between tax buoyancy and economic growth in Sierra Leone by estimating difference tax buoyancies measures using total tax revenue, nominal GDP, import and private consumption as key variables. Buoyancy of total tax revenue has been estimated with respect to nominal GDP, which is the base for overall tax revenue. The buoyancy of total tax revenue with respect to imports has also been estimated, measured as a base for customs and excise duties. Finally, buoyancy of tax revenue to private consumption has been estimated, which is a base for goods and services tax (GST). These buoyancies have been compared to know which is the biggest that propels economic growth and development in the country. The study concludes from the various buoyancies estimated that buoyancy of total tax revenue with respect to private consumption, the component that captures goods and services tax is the biggest. Hence, based on the outcome of this revelation, it is recommended that government should focus more attention on increasing the tax base for goods and services tax instead of increasing tax base for customs and excise duties.

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