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Banking Sector Stability in Sierra Leone: An Econometric Analysis

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Abstract
This study assess banking sector stability in Sierra Leone using quarterly data over the period 2009-2019 of the fourteen banks in the sector. The study was carried out in the context of Johansen Cointegration estimation technique and it was found out that in the long run, total bank assets, gross loans positively influence banking sector stability whilst exchange rate had negative effect on banking sector stability. In the short run, total banking assets was also found to have a positive and statistically significant relationship. Arising from the aforementioned estimation results, this study recommends that banks transition to Basel three Capital Framework which is forward looking that shore up the stability of the banking sector and makes provisions for risks that will emanate in the banking realms of Sierra Leone. This is turn will facilitate smooth banking operations and fortifies public confidence in the banking sector.

1.0 Introduction

In the international arena, drivers of growth and development are multifarious, that said the stability of the banking sector is viewed as a catalyst to strengthen financial stability. In particular, the banking sector is a significant part of the financial sector and it channels resources from deficit to surplus units via financial intermediation. This in turn translates to boosting economic growth via gainful employment opportunities and launches the economy on a sustainable trajectory.

Banking sector stability refers to the ability of the banking sector to withstand shocks and continue its function smoothly whilst improving the public confidence. This means that the banking sector is serves as a shock absorber to both internal and external vulnerabilities. The banking sector is a focal lever in the financial system dynamics as it intermediates amongst surplus and deficit units, manages risks (financial &economic) and facilitates the creation of employment opportunities via intermediation of funds and a key vehicle for monetary stability in the monetary policy dynamics.

It is a truism that banks are the driving membranes and amongst the most leveraged given the prime moving roles they play and the ecosystem within which they operate, specifically how they interact with the rest of the economy. That being said, the international banking sector has faced crises, in particular the 2008/2009 Global Financial Crises which shook the international landscape tremendously. This prompted regulators to rethink and recast the Basel II Capital Framework to a more standardized Basel III framework which addressed the shortcomings of the international banking sector under Basel III capital framework. In that regard, the banking sector resilience has been further buttressed.

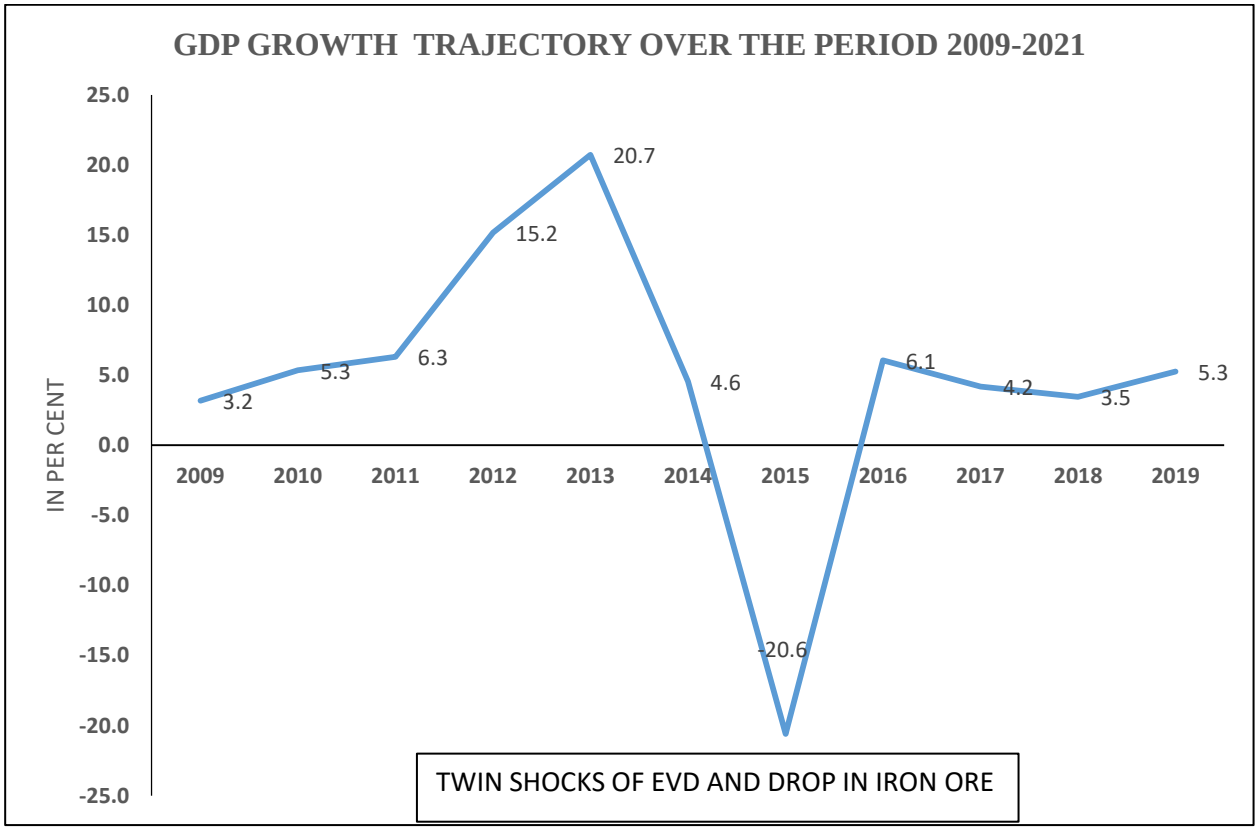
On a more regional bloc, it is true that the economic outlook for Africa (AEO) in 2019 portended that the economy of Africa has the growth potentials that are sustainable regardless of the challenges faced in the region. That said, the sustainability level is anchored on the financial system stability but also on the banking sector stability in particular and its drive to propel the economy by funding and stimulating economic activities. Again, this is entrenched on the robustness of the African economic bloc financial system intermediation impetus despite its crises some part of the bloc.

That said, the financial system in Sierra Leone comprises of the banking sector and the non-bank sectors. The banking sector embodies the fulcrum of the financial sector with it comprise of about 80 per cent of the assets in the financial sector. This means that for the financial sector to be resilient the banking sector has to be fortified. More to the banking sector, it comprises, The banking system is composed of fourteen (14) Commercial Banks; two (2) state owned banks, two (2) domestic private owned banks and ten (10) foreign owned subsidiaries mainly from Nigeria, all regulated under the Banking Act 2019. The fact that the

banking sector is the primary player in the cash markets, elicits a structural stance that prompts the need to evaluate the banking sector stability in Sierra Leone.

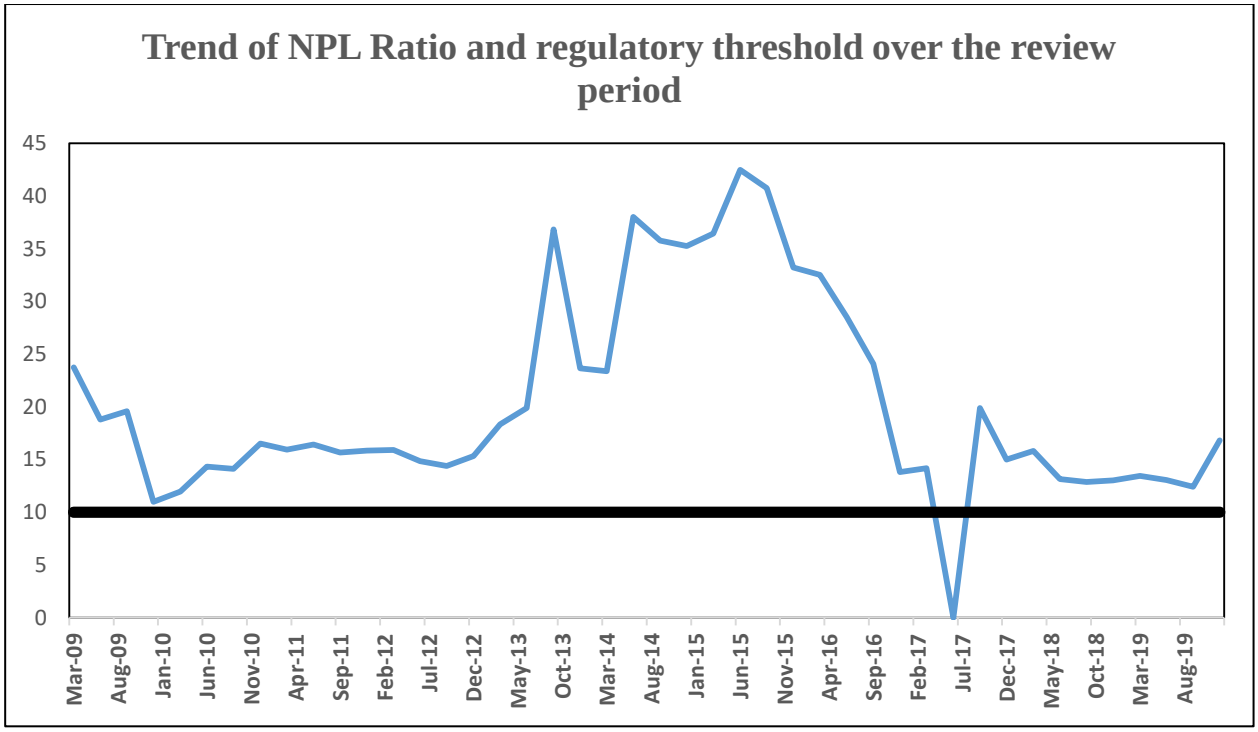
1.2 Research Issue

The economic trajectory of Sierra Leone has been one with ups and downs marked by internal and external shocks. On average, Sierra Leone's economy has continued to grow by 4.2 per cent since 2009.



Source: World Bank's WDI

Banks efficiency have improved not only on a micro-perspective, but more so on a macro-perspective albeit some prudential measures deployed to safeguard the banking sector. The need to strengthen banking sector stability despite some financial skirmishes, and confronted with internal and external pressures, are catalysts of the BSL's crucial and comprehensive policy measures. The BSL has deployed far-reaching prudential and regulatory safeguards during the life-cycle of the banks. These include revised Acts, Guidelines and Regulations. Banking sector stability has focused on ensuring a safe, sound, stable and profitable banking sector. This embeds the protection of depositors' funds which is paramount and also the alignment of boosting shareholders' equity. The banking sector in Sierra Leone has been resilient in the midst of a taxonomy of risks including credit risk(that loans that banks made will not be repaid.), market risk (that assets will become worthless due to changes in market prices), operational risk (that internal processes including governance, control systems, amongst others will fail) , Liquidity risk that it will be hard for banks to meet short-term obligations, leading to fire sales of assets and interest rate risks amongst others. Other measures employed by the central bank of Sierra Leone were directed at putting the banking sector on a firmer footing.



Source: BSL

Despite the channel toward a germane macroeconomic outlook, risks are still present in the banking sector including liquidity risks, market risks and operational risks. These are often coupled with panic or bank run in which there is a call on deposits from banks. Beyond these concerns the matter of banking sector stability is very key because as complexities and diversities of the banking sector dynamics have increased in the past the likelihood effect of banking sector instability on the economy has also increased. With non-performing loans ratio on the high side since 2009 averaging 20.39 per cent amidst a regulatory threshold of 10 per cent, the resultant increase in loan risk has burdened monetary policy and more so financial stability policy. Against a background of an already high cost of operations by banks, further increase on NPLs ratio on the main would dampen confidence and reliability thus becoming deleterious and inimical to growth and further development of the banking sector in particular and the financial system in general. A disintegration of the NPLs revealed that the substandard, doubtful and loss categories are exacerbating the NPLs ratio. This means that these three (3) key elements are the drivers for these the decline in asset qualities.

Fiscal dominance is a prime contributor for the unfavorable trade-off between inflation and growth, wherein monetary policy must be tightened (a hawkish stance) regardless of the catalytic growth of personal credit. That said, stress testing exercises conducted by the central bank reflect that the banking sector is resilient and stable. (BSL FSR 2019). Furthermore, the banking sector was still experiencing deficit in terms of corporate governance issues (weak governance structures amongst others). These shortcomings or weaknesses amongst others prompted the central bank to increase banks minimum capital levels from Le30bn to Le85bn in 2021 over a three year period in tranches. Given the different measures that BSL has brought to bear on the prudential and regulatory perimeter of the banking sector, with attendant asset quality issues raising its ugly head, the question still persists how stable is the banking sector of Sierra Leone ?, how diverse is the banking sector of Sierra Leone.? Therefore, this study unravels the stability and diversity of the banking sector of Sierra Leone. In that regard, the objectives of the study is to first assess the banking sector's stability and secondly is to explore the diversity level of the banking sector employing their concentration index.

Banking sector stability and diversity is of paramount focus to economists, policy makers and other stakeholders. This core interest has been elicited by economists and other policy makers amongst others. The interest had been enshrined on the debate of entering a variable in elucidating growth and development of a country, had been contributed to by Bretton woods institutions and other researchers. It is astonishing that few studies have been done on financial stability in Sierra Leone. For instance, Jackson and Tamuke(2022) assessed the credit risk management and the financial performance of domiciled banks in

Sierra Leone using unbalanced panel data methodology using quarterly data over the period 2008-2018 with only eight banks. Their findings were that weaknesses of the banking sector stems from NPLs ratio. They also provide evidence that a low productive base in the domestic economy influences the state of high NPLs in the banking system.

From a more focused point, the astonishment of few studies being done on banking sector stability and diversity also emanates from the fact that the banking sector of Sierra Leone accounts for about 80 per cent of the assets in the financial system, which makes it very significant in determining the stability and diversity of the banking sector. This study supersedes that done by Jackson and Tamuke(2022) because it takes a macro-prudential dimension of the entire banking sector comprising of fourteen banks and more so employs the standardized Financial Soundness Indicators(FSIs) portended by the IMF to allow for comparables amongst country financial landscapes.. It is the first empirical research to the best of the researcher's knowledge to actually focus on the banking sector stability by encapsulating all fourteen banks in the Sierra Leone jurisdiction.

With regards to methodology, a plethora of methods are available in the literature for empirical analysis. Employing any of these methodologies depends on the country specific factors that may have various effects of the estimates generated. Three key facets come to the fore, including variable measurement, estimation techniques and scope. However, the method put forward by the authors –the unbalanced panel fixed effects suffers from some limitations, including a culture of omission, low statistical power, limited external validity, restricted time periods, measurement error, time invariance, undefined variables, unobserved heterogeneity, erroneous causal inferences, imprecise interpretations of coefficients, imprudent comparisons with cross-sectional models, and questionable contributions vis-à-vis previous work. Instead of discouraging the use of fixed-effects models, we encourage more critical applications of this rigorous and promising methodology. The most important deficiencies—Type II errors, biased coefficients and imprecise standard errors, misleading *p* values, misguided causal claims, and various theoretical concerns—should be weighed against the likely presence of unobserved heterogeneity in other regression models. Ultimately, it is important to do a better job of communicating the shortcomings of fixed effects.

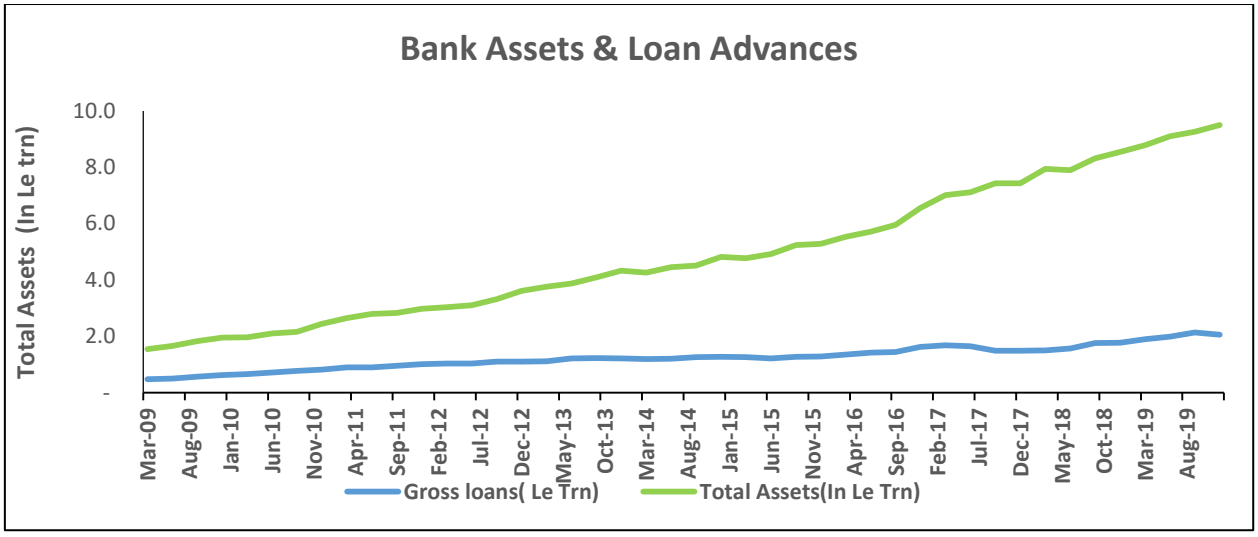
Therefore to overcome this methodology, this study examines the stability and diversity of the banking sector using relevant econometric analysis that encapsulates the behavior of the variables of interest. The findings of this study would provide a fresh comprehension of stability and diversity of the banking sector in Sierra Leone and offer a platform to keep policy makers more informed and portend prescriptive policies that will boost the sector performance in Sierra Leone.

2.0 Synopsis of Sierra Leone's Banking Sector

The banking sector is the prime mover of financial intermediation wherein funds are transferred from surplus to deficit spending units. The key players in the banking space are the commercial banks. The banking sector is composed of fourteen (14) Commercial Banks; two (2) state owned banks, two (2) domestic privately owned banks and ten (10) foreign owned subsidiaries mainly from Nigeria, all regulated under the Banking Act 2019. It is pertinent to indicate that the central bank is part and parcel of the banking sector.

Indeed banks are key as they on lend to finance and boost growth and development in the country. Primary amongst their functions include accepting of deposits, granting credits and transfer of funds on customers' behalf. The banking sector is a crucial mechanism for transmitting economic policies of government especially via the monetary policy transmission by the central bank which regulates the cost and availability of credit in the economy.

Given their substantial role, sensitive features and the focal point that banks' capacity affect economic growth largely depending on their efficiency, the central bank has continued to adopt a comprehensive nest of policies that put the banks on a firm footing by improving banks' safety and soundness.



Source: BSL

The banking sector diffusion has been such that the paid-up capital was increased due to the new regulatory directive which required all commercial banks to increase their minimum paid up capital from Le30bn to Le45bn in 2019, but further increased to Le85bn in 2021. Due to the regulatory tsunami of policies rolled-out by the central bank, the effects have translated into influencing macro-economic conditions in the banking sector via the increase in total assets of banks, loans and advances have increased but NPL ratio on the average has increased. On structural basis, this permeation has also improved the banking sector.

3.0 Review Of The Relevant Literature

On the global scene, a myriad of studies have unraveled the stability and diversity of the financial sector in Africa but very few in Sierra Leone. This article conducts empirical analysis to select a suitable technique to be used as well as seeing how estimated findings support theoretical discourse on the variables of interest. It further delineates the literature review based on selected studies done outside Africa and studies done within Africa. And more so studies done in Sierra Leone.

3.1.1 Studies Outside Africa

Ntarmah et al(2019) averred the impact of Banking system stability and economic sustainability on some selected developing countries using a panel data methodology of 37 developing countries over the period 2000-2016. The study made the following key findings: First, the study revealed that banking system z-scores has positive effect on economic sustainability of developing economies while banking system regulatory capital and bank credit have negative effects on economic sustainability among selected developing economies. Second, while banking system z-scores, bank liquid assets and bank credit have positive effects on economic sustainability of BRICS economies, bank liquid assets and bank credit have negative effects on economic sustainability of non-BRICS economies except banking system zscores, which has a positive effect. In addition, banking system z-scores has positive effect on economic sustainability of Asian and non-Asian economies. However, non-performing loans and bank credit has negative effects on economic sustainability of Asian economies while banking system regulatory capital has negative effect on economic sustainability of non-Asian economies. We conclude that banking system stability play a role in economic sustainability developing economies. However, banking system stability has differing effects on economic sustainability of BRICS and non-BRICS economies; and Asian and non-Asian economies.

Jayakumar et al(2018) examined whether feedback effects permeate banking stability, banking competition and economic growth for thirty-two European Countries over the period 1996-2014 using a panel VECM methodology. Their study revealed that both banking competition and banking stability are significant long-term drivers of economic growth in the European countries. A corollary to this policy-wise is that economic policies should recognize the differences in the relationship between both banking competition and banking stability in order to maintain sustainable economic performance of these countries.

Abuzayed et al(2018) explored bank diversification strategies and nexus to financial sector stability. Using a sample of listed and unlisted banks operating in the Gulf Cooperation Council (GCC) countries over 2001

to 2014 we investigate the diversification features of conventional and Islamic banks. Our main finding overall is that income or asset diversification does not enhance bank stability. However, there is evidence of a non-linear relationship between non-interest (non-financing) income and stability indicating that banks are able to reduce risk at higher levels of diversification. Conventional banks appear to be more adversely impacted on the risk side than Islamic banks. We also find that factors such as improved institutional quality, macroeconomic conditions, and other bank-specific factors bolster greater stability.

3.1.2 Studies Inside Africa

Aluko(2018) explored the determinants of banking sector with evidence from sub-saharan african that This study examines the determinants of banking sector development in sub-Saharan African countries using a panel of 25 countries from 1997 to 2014. It utilises the system Generalized Method of Moments (GMM) dynamic panel model estimator. Using a composite index of banking sector development, the estimation results show that population density and simultaneous openness to trade and capital promote banking sector development while financial liberalisation hinders banking sector development. This study reveals that institutional quality, population density, and trade openness increases the depth of the banking sector. Also, it demonstrates that law, inflation, and religion promotes the efficiency of the banking sector while latitude, trade openness, income level, and ethnic diversity reduce banking sector efficiency. In addition, it shows that law and simultaneous openness to trade and capital enhances the stability of the banking sector while land area, financial liberalization, economic growth, and inflation adversely affect banking sector stability.

Udom et al (2018) assessed the Financial System Stability over the period 1997 and 2016 using the macro prudential approach and employing time series methodology to unearth the weaknesses and strengths of the banking sector in Nigeria. The study showed that by the end of 2016, clear signs of impending crises had started to emerge in the system. The suggestions proffered for ameliorating such a crises include the moderation of inflation, close monitoring of the risk management framework of the banks and strict enforcement of corporate governance standards. Their study could have been enhanced by the including by using dummy variables to account for events that would have more enriched the study.

Ogbeide et al (2017) explored banking sector performance embedding financial regulations in Nigeria over the period 1993-2016 using cointegration methodology. Their findings revealed that the effect of various financial legislations and reforms on Nigerian banks performance and most regulation measures should be publicized frequently to build trust and transparency in the banking sector in particular and the financial system in general. Their study could have been improved by including more financial soundness indicators that encapsulate the health of the banking sector.

Nderitu(2016) assessed the impact of elements that exacerbate risks of commercial banks in Kenya over the coverage 2008-2014 and employing panel Generalized Method of Moments estimation methodology. The study revealed that borrowing risk exposure was found not to be persistent, was impacted by the magnitude and velocity of concentration and also external sector exposures. Their study could have been enriched by giving specifics for Kenya on what monitoring indicators could be deployed to yield the substantial benefits of managing banking sector risks.

3.1.3 Studies in Sierra Leone

Jackson and Tamuke(2022) explored the credit risk management and the financial performance of domiciled banks in Sierra Leone employing unbalanced panel data methodology with quarterly data over the period 2008-2018 with only eight banks. Their findings were that weaknesses of the banking sector stems from NPLs ratio. They also provide evidence that a low productive base in the domestic economy influences the state of high NPLs in the banking system.

This study embeds all banks in Sierra Leone and accounts for the Ebola Virus Disease period via a dummy variable. It is against this backdrop that the evidence from this study will keep policy makers more informed about the banking sector dynamics.

4.0 Theoretical Framework and Methodology

The theoretical framework for assessing banking sector stability in Sierra Leone is entrenched on the Learner Index Theory as a key indicator of banking sector's competitiveness. In its simplest form, it enables market power to prompt firms for setting price above the marginal cost. It is estimated thus:

$LER_{i,t} = (K_{i,t}-MC_{i,t})/K_{i,t}$ ----------(1)

Where:

$K_{i,t}$ = Bank i price at year t,

$MC_{i,t}$ = Marginal Cost

Larger index values mean more maker power or strength. The output price V is estimated as total revenues over total assets. Consistent with Beck et al(2013), a conventional marginal cost is couched using one output, three input and one-time trend translog cost function, hence resulting in a specification thus:

$$\ln TC = \bar{g}+\bar{g}_1 \ln V + \sum_{j=1}^{3} \gamma j \ln\beta 1 + \sum_{j=1}^{3} \gamma j \ln\beta 2 + \sum_{j=1}^{3} \gamma j \ln\beta 3 + \eta 1t + \eta_2/2t^2 + \xi it \text{---------(2)}$$

Where:

TC = Total Cost

V = Commercial bank single output proxied by total assets

$\beta_1, \beta_2, \& \beta_1 =$ Prices used in the production process

$\beta_{1,=}$ Price of Labour, (expenses on personal divided by total assets)

$\beta_{2=}$Price of physical capital (other admin outlays added to other operating expenses all divided by total expenses)

$\beta_{3=}$Price of borrowed funds (interest expenses divided by total deposits)

t = Time trend encapsulating the cost function behavior over time

$\bar{g}$, γ and η = estimated coefficients

ξit = Two component error term

From equation 2, marginal cost is given as :

$$\mathbf{MCi,t = (TCi,t /V i,t)} \left[\bar{g}_1 + \bar{g}_2 \ln V + \sum_{j=1}^{3} \gamma j \ln\beta j + \eta 3t \right] \text{----------(3)}$$

By including bank stability, bank z-score(standard score) is employed and has been widely used in the banking literature(Iannota et al 2007;Laeven and Levine, 2009). The study leverages on this key indicator and is estimated as the difference between ROA and its mean divided by the standard deviations by which returns have to reduce in depleting banks equity. This follows as:

$$\mathbf{BZscore_{i,t}} = \frac{ROAi,j + \mu(ROA)}{\sigma(ROA)} \text{----------(4)}$$

Where:

ROAi,t = Return on assets for bank i in current period t

μ(ROA) = Average of return on assets

σ(ROA)= Standard deviation of return on assets

BZscore is a gauge of bank soundness. Greater values mean a greater degree of solvency and thus it offers a direct indication of stability. Because banks are in the business of managing financial risk by on lending activities as their major source of earnings rather than intermediation activities, the study notes that banks' stability is strictly akin to loan quality. Therefore, loan assets is also a variable of choice.

4.1 Methodology

The model to explore the banking sector stability in Sierra Leone is a prolongation of the recast version of the Lerner Index of perfect competition mirrored by Cihak&Hesse(2007). This is illustrated as follows:

$$\mathbf{BZi,j,t = \bar{g} + \bar{g}_1 O_{i,j,t} + \bar{g}_2 S_{j,t} + \bar{g}_3 T_{j,t} + \bar{g}_4 TI_{j,t} + \bar{g}_5 M_{j,t} + \xi_{i,j,t}} \text{ ----------(5)}$$

Where:

BZi,j,t = Regressand for bank I in country j and at time t

$O_{i,j,t}$ = Vector of banks particular variables

$I_{j,t}$ = Vector of banking industry specific variables in country j

$T_{j,t}$ & $TI_{j,t}$ = Banks type and interaction between the type and some of the industry –specific variables as well as bank specific variables respectively

$M_{j,t}$ = Vectors of Macroeconomic variable.

$\xi_{i,j,t}$ =Residual

More specifically, the estimated recast form of equation 5 is expressed in log-linear form to interpret the coefficients as elasticities in equation (6)

$$\mathbf{LnBZscore_t = \gamma_0 + \gamma_1 LnTBA_t + \gamma_2 LnGL_t + \gamma_3 LnNEXR_t + \gamma_4 EVDUM + U_t} \text{ ----------(6)}$$

Where**: U ~ ii N (o, σ^2)**

BZscore **=** Bank Zscore

TBA = Total Bank Assets

GL = Gross Loans

NEXR = Nominal Exchange Rate

EVDUM = Ebola Virus Disease Dummy variable

4.1.1 Banking Sector Diversity Index

To address the issue of banking sector diversity, mirroring Michie et al(2013), the banking sector diversity index for Sierra Leone is crafted on market competition and concentration index. Of the banking sector in Sierra Leone over the review period. The study encapsulates all banks to give a comprehensive assessment of the dynamics in the banking sector. Ideally, it is pertinent to point out that the banking sector accounts for the lions' share (about 80 per cent) of the financial system.(BSL Financial Stability Report, 2018). The concentration index gauges the degree of concentration and competition in the banking sector. The Herfindahl-Hirshman Index is used to assess the banking sector concentration for diversity. From an algebraic perspective, it is calculated thus:

$$\text{HHI} = \sum_{k=1}^{n} \left(\left(\frac{qk/}{q}\right)\text{^}2\right) = \sum_{k=1}^{n} (\text{rk})\text{^}2 \quad \text{----------(7)}$$

Where:

n = Number of banks in the banking sector

qk =Volume of bank k's output

Q = Total volume of banking sector's output

rk = Bank k's share of the banking sector's output

k= Banking unit.

4.1.2 Estimation and Simulation

4.1.3 The Data

The paper's coverage is from 2009-2019 using quarterly data as this period embodies fresh policies that have been instituted and manifested in the banking sector. Furthermore, this period is sufficient to examine the stability and diversity of the banking sector in Sierra Leone. Data on total bank assets and gross loans was sourced from the Bank of Sierra Leone's Financial Soundness Indicators as espoused by the IMF for standardization across countries.. Bank Z-score was calculated also using this data source. That said, exchange rate was sourced from the Banks' Data Warehouse over the period.

5.0 Estimation Results

This section presents the results of the empirical estimations and discussion of the findings. The results were estimated and the estimates are interpreted accordingly.

To ascertain the stationarity of the variables, the study employed the Augmented Dickey Fuller (ADF) test for unit roots. The results are shown in Table 1.

Table 1: Units Root Test Results

Variables	ADF-test levels; I(0)	ADF test (First Difference; I(1))	Implication	Order of Integration
	P-values	**P-values**	**Key takeaway**	**Message**
LBZscore	0.4522	0.0000*	A Stationary Variable	I(1)
LTBA	0.1039	0.0000*	A Stationary Variable	I(1)
LGL	0.0524	0.0004*	A Stationary Variable	I(1)
LNER	0.9780	0.0009*	A Stationary Variable	I(1)

Source: Author's estimation from research data

Note: * , ** and *, imply 10% level of significance 5% and 1% level of significance respectively**

Granger Causality Test

The paper used Granger causality test to determine the causality between financial stability (zscore) and exchange rate over the period under study. This test is done to establish whether there is a unidirectional or bidirectional causal relationship between financial stability and exchange rate. To determine the causal relationship between financial stability and exchange rate the Granger causality test is employed. This test is relevant to the study as one of its key objectives is to determine the causal relationship between financial stability and exchange rate over the period under review.

Pairwise Granger Causality Tests			
Sample: 2009Q1 2019Q4			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.

DZSCORE does not Granger Cause DLNEXR	42	1.46027	0.2452
DLNEXR does not Granger Cause DZSCORE		2.00028	0.1497

Source: Author's estimation from research data

The results of the Granger causality test in a bi-variate regression between Financial stability (zscore) and nominal exchange rate (NER) with lag of 2. The test rejects the null hypothesis 'NEXR does not granger cause financial stability ' and indicates that at the 5% level of significance it is preferable to predict DZSCORE by knowing DLNEXR than without knowing it. This implies that Granger causality is unidirectional moving from DLNEXR to DZSCORE and not the reverse. The implication is that an appreciation of the exchange rate results in lower price of imported goods in domestic currency terms and thereby enhances the imports volume. Given that many Sierra Leonean businesses are heavily dependent on imported inputs, the appreciation of the domestic currency (the Leone) will decline production cost and eventually strengthen the stability of the banking sector.

Another key pointer is the potential currency mismatch on banks' balance sheet that adds further pressure on the exchange rate. Available data indicate that commerce and finance forms the larger part of credit, and this involves mostly imports and very little exports. With regards to the imports, importers largely rely on foreign currency (US Dollars) to import their goods/commodities from abroad and therefore request foreign currency from banks to facilitate their transactions. Banks in that regard, may use foreign currency deposits to service domestic liabilities. Given that demand for foreign currency is higher than the supply, the switching effects results in further depreciation and this has implications for inflation.

Vecm Long Run Relationship

Vector Error Correction Estimates				
Date: 04/05/22 Time: 13:11				
Sample (adjusted): 2009Q3 2019Q4				
Included observations: 42 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
Cointegrating Eq:	CointEq1			
LZSCORE(-1)	1.000000			
LTBA(-1)	0.577149			
	(0.37202)			
	[1.55141]			
LNEXR(-1)	-2.206732			
	(0.37272)			
	[-5.92057]			
LGL(-1)	0.478885			
	(0.35420)			
	[1.35201]			
C	1.750725			

Source: Author's estimation from research data

The above table contains the estimates of the long-run parameters, along with their standard errors and t-statistics. All the variables are significant at 5% level of significance. In the long run, total bank assets has a positive impact on financial stability(Bzscore) with a coefficient of 0.57, meaning a unit change in total bank asset will lead to 0.57 unit in banking sector stability(Bzscore) in the same direction, indicating that the two variables are directly related. The implication is that accretion of total bank assets boosts banking sector stability measured by Bzscore by 0.57 unit.

Additionally, exchange rate (nexr) has a negative impact on financial stability (Bzscore) with coefficient of -2.21 meaning a unit change in nominal exchange rate will lead to 2.21 units in banking sector stability (Bzscore) in the opposite direction as the two variables are inversely related. Thus depreciation is expected to bolster banking sector stability as measured by Bzscore by 2.21units. Furthermore in the long run, gross loans has positive impact on banking sector stability (Bzscore) reflecting a coefficient of 0.48 meaning a unit change in gross loans will lead to 0.48 unit increase in banking sector stability measured by Bzscore. This is reflective of the savings investment nexus such that gross loans will be directed at the sector levels to stimulate economic growth and the repayment of these loans(plus interest) in due time will boost economic growth in Sierra Leone. A corollary to this is that both private and public sectors are catalyst for propelling economic growth in Sierra Leone.

Short Run: Error Correction Model (Speed Of Adjustment) And Short Run Model

Dependent Variable: D(LZSCORE)				
Method: Least Squares				
Sample (adjusted): 2009Q3 2019Q4				
Included observations: 42 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-0.347569	0.062799	-5.534588	0.0000
D(LZSCORE(-1))	-0.228342	0.110866	-2.059622	0.0469
D(LTBA(-1))	1.908519	0.421368	4.529337	0.0001
D(LNEXR(-1))	-2.309947	0.530452	-4.354674	0.0001
D(LGL(-1))	0.235118	0.290899	0.808246	0.4244
C	-0.043287	0.021485	-2.014733	0.0517
EVDUM	0.111787	0.029101	3.841311	0.0005
R-squared	0.584722	Mean dependent var		0.012208
Adjusted R-squared	0.513531	S.D. dependent var		0.094672
S.E. of regression	0.066031	Akaike info criterion		-2.446372
Sum squared resid	0.152603	Schwarz criterion		-2.156760
Log likelihood	58.37381	Hannan-Quinn criter.		-2.340218
F-statistic	8.213471	Durbin-Watson stat		2.109629
Prob(F-statistic)	0.000014			

Source: Author's estimation from research data

The table above shows the estimated coefficient of the error correction model (negative), indicating convergence towards long run equilibrium, and reports the coefficients of the short-run parameters, along with their standard errors and t-statistics. The error correction term(ecm-1) coefficient of approximately -0.34 indicates that approximately 34% of shocks can be justified as a long run trend, thus convergence towards the long run equilibrium. The implication of this is that deviations in the GDP away from the equilibrium are corrected by 34% within a year.

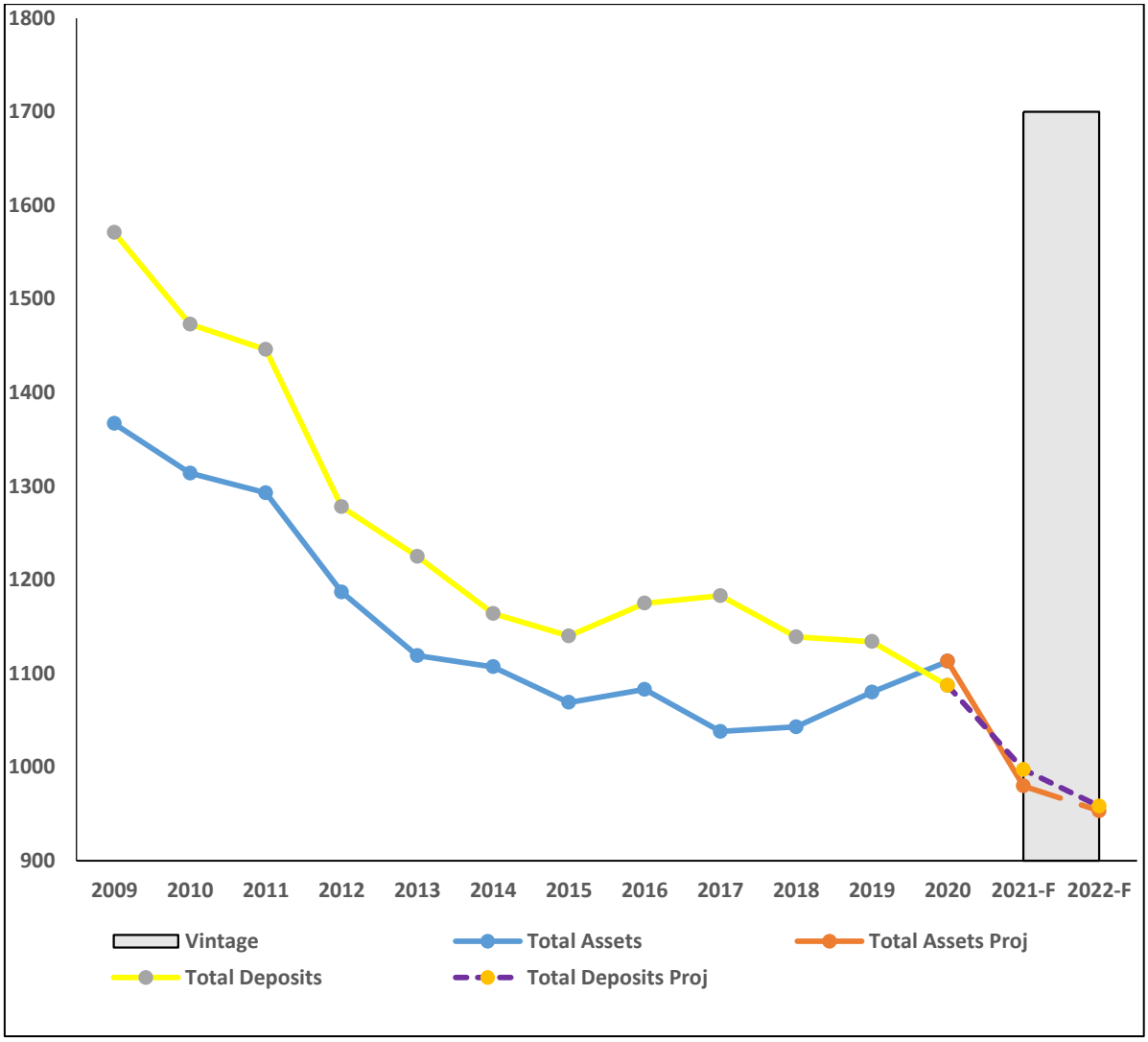
The short run coefficients were significant at the 5% level of significance, except gross loans at first period lag and Ebola Virus dummy whose sign as ambiguous as it is positively signed. In the short run, bank zscore has negative and significant impact on its own comporaneous value after at lag one. Total Bank assets has positive and significant impact on banking sector stability (Bzscore) with coefficient of 1.91 units. This

supports the fact that in the short term, bank assets a paramount to shore up banking sector stability. Exchange rate at first period lag was significant at the 5% level of significance, but has a negative effect on banking sector stability with a coefficient of -2.31 units. This implies that a unit change in nominal exchange rate is expected to trigger 2.31 of baking sector stability in the opposite direction. Thus depreciation of the nominal exchange rate at first period lag is expected to boost banking sector stability (Bzscore) ceteris paribus.

It is astonishing to note that the ebola virus dummy was positively impacted and significant impact on banking sector stability. This may be attributed to the fact that over the ebola virus period the banking sector was at resilient and could withstand the shock whilst continue running its operations smoothly.

The overall fit of the model is such that R^2 has a value of 0.58.This shows that 58% of the total variations in banking sector stability is explained by its regressors.

Herfindahl Hirschman Index of Market Competition



Source: Author's computation 2019&2020

Concentration Index

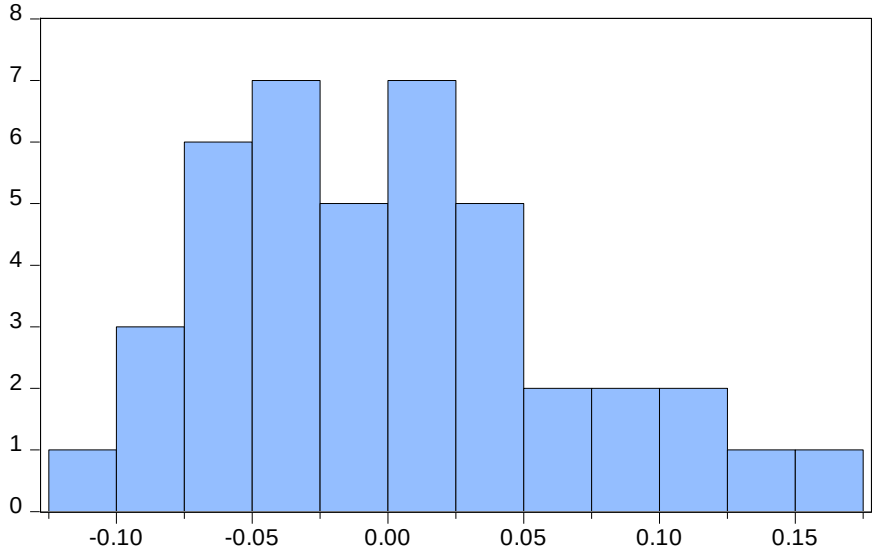
The chart above reflect concentration and diversification index of the banking sector in Sierra Leone using Herfindahl Hirshman Index(HHI). In this analysis, concentration is portrayed in terms of total assets and total liabilities in the banking sector. With regards to total deposits for 2019 reflects 1134 which is below, the threshold of 1500 and this reflects a competitive banking sector. With respect to total assets for 2019 portrays 1080 which is also below the threshold of 1500 and confirms a competitive banking sector in Sierra

Leone. Taken together, the HHI confirms that the banking sector as a whole is competitive.Furthermore, simple forecast based on simple regression technics are extracted for 2021 and 2022 going forward.

Diagnostics Tests

In order to ascertain the reliability of the estimated results, the following diagnostic test was conducted; Residual Normality Test, Heteroskedasticity test, autocorrelation, CUSUM and CUSUM of squares.

Residual Normality Test



Series: Residuals
Sample 2009Q3 2019Q4
Observations 42

Mean	8.28e-18
Median	-0.007241
Maximum	0.150106
Minimum	-0.118753
Std. Dev.	0.061008
Skewness	0.543847
Kurtosis	2.974258
Jarque-Bera	2.071543
Probability	0.354952

Source: Author's estimation from research data

The results of the normality test show that the errors of the banking sector stability model are normally distributed with mean zero and standard deviation of one. This means that the errors of the Bzscore model are normal since p-value is greater than the 5% significance level.

Heteroskedasticity test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.015703	Prob. F(6,35)	0.4312
Obs*R-squared	6.228544	Prob. Chi-Square(6)	0.3981
Scaled explained SS	4.269705	Prob. Chi-Square(6)	0.6402

Source: Author's estimation from research data

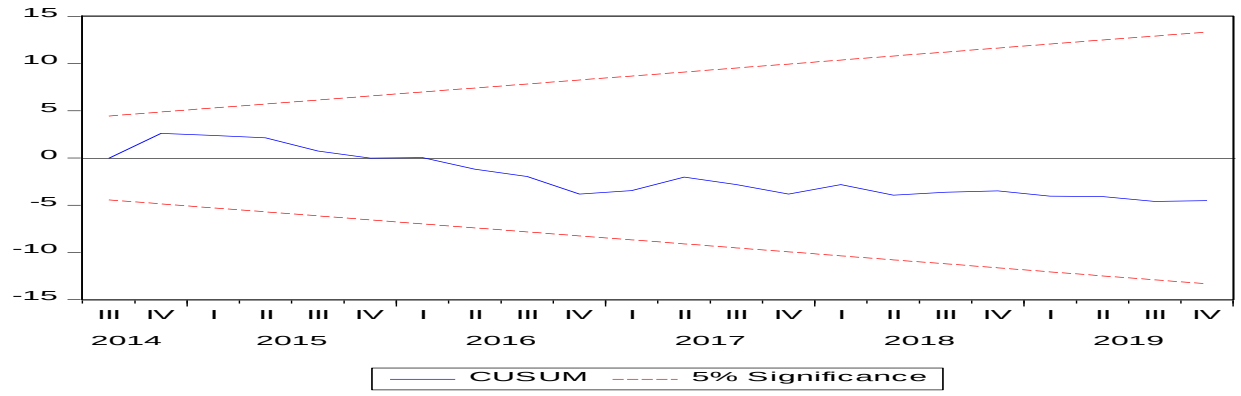
The results of the Heteroskedasticity White test show that the errors of the banking sector stability model are homoscedastic. This Heteroskedasticity White test regresses the banking sector-regressors upon the residuals to test if the Bzscore-regressors can explain the residuals. Since the p-value of the F-statistic is greater than 5% significance, the errors of the Bzscore model are homoscedastic.

Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.177521	Prob. F(2,33)	0.8381
Obs*R-squared	0.447061	Prob. Chi-Square(2)	0.7997

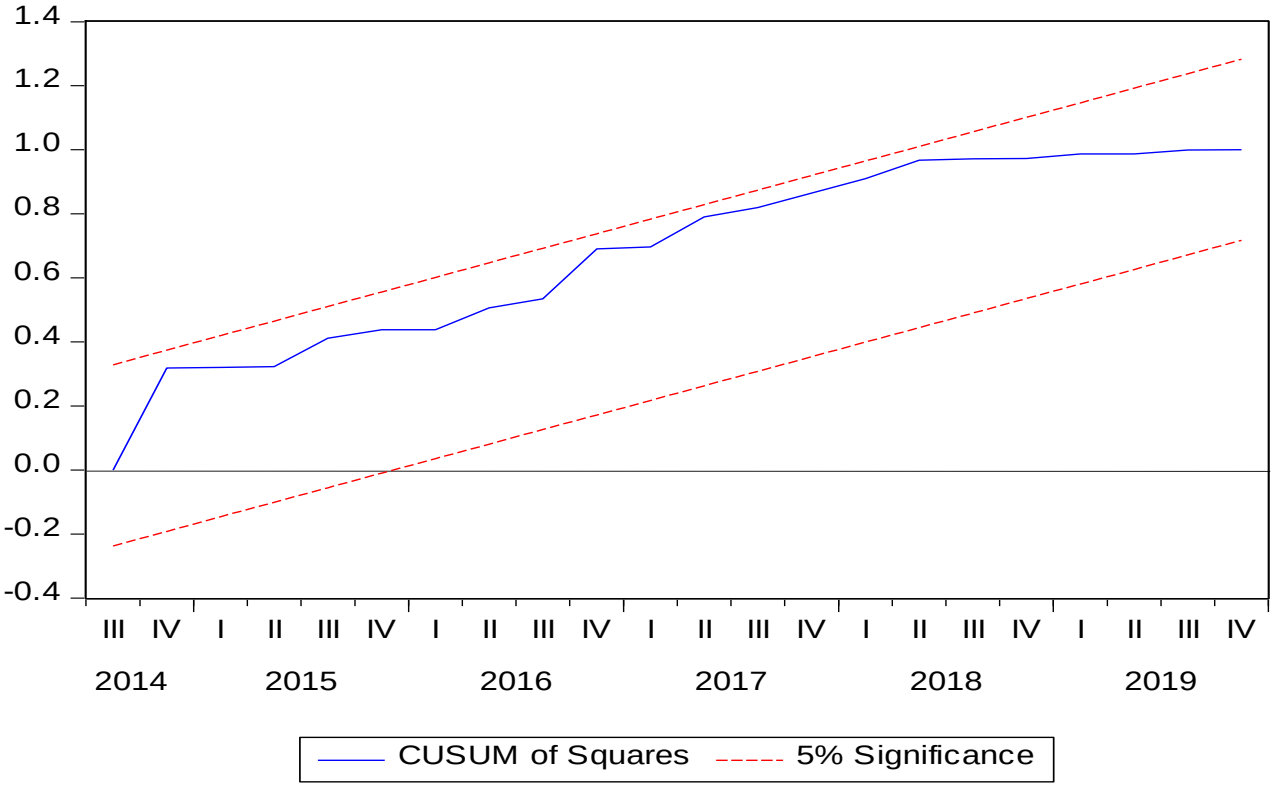
Source: Author's estimation from research data

CUSUM



Source: Author's estimation from research data

CUSUM of squares



However, the CUSUM squared stability Test (Brown, Durbin, Ewans) is such that the curve does not touch the corridor meaning that the banking sector stability model is structurally stable at 5% level of significance.

6.0 Conclusion &Policy Implications

6.1 Conclusion

The paper was carried out to investigate the banking sector stability in Sierra Leone using an econometric analysis by using quarterly data over the period 2009-2019. The paper carried out this research using the Johansen modeling approach to co-integration and error correction analysis. The paper found that total banking assets positively and significantly affects financial stability in the short and long run. The short-run and long-run effects of exchange rates on banking sector stability were found to be statistically significant. Gross loans has a positive and statistically significant impact on banking sector stability measured as bank z-score. Another intriguing conclusion is that in the short run bank zscore has a negative but statistically significant relationship at lag one. Furthermore, ebola virus dummy variable has a positive relationship but not statistically significant on banking sector stability. Thus, total banking assets, gross loans and

exchange rates are a major determinant of banking sector stability in Sierra Leone. This can be attributed to the fact that these variable are the catalyst of banking sector stability in Sierra Leone. Based on the empirical evidence, it is recommended that the central bank of Sierra Leone work with together government to strengthen banking sector stability in Sierra Leone. This is done through the transitioning to Basel three(3) capital framework. Furthermore, central bank regulators should also put a threshold on non-performing loans to stem the deterioration in asset quality. Another key point is the Central Bank of Sierra Leone to increase on-site supervision to confirm the bank assets and liabilities are consistent with what the banks submit via their returns. Additionally, the onsite supervision would keep the central bank of Sierra Leone apprised of banks' corporate governance dynamics and how risks can be stem and provided for by banks when they crystalize.

ANNEX

	ZSCORE	TBA	NEXR	GL
Mean	5.283243	4920873	5561.4	1246436
Median	5.138515	4486793	4520.845	1226188
Maximum	6.968915	9497899	9711.32	2133746
Minimum	3.720784	1549190	3103.74	481153.4
Std. Dev.	0.960613	2389852	1830.593	414035.7
Skewness	0.289873	0.404534	0.765628	0.137206
Kurtosis	1.914524	1.959124	2.249115	2.525506
Jarque-Bera	2.776332	3.186359	5.332385	0.550818
Probability	0.249533	0.203278	0.069516	0.759262
Sum	232.4627	2.17E+08	244701.6	54843189
Sum Sq. Dev.	39.67943	2.46E+14	1.44E+08	7.37E+12
Observations	44	44	44	44

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