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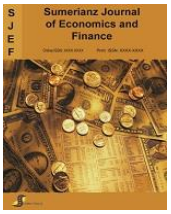

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Auto-Regressive Distributed Lag Approach of Financial Intermediation of Commercial Banks and Risk in Nigeria

Dr. IYO Ipeghan*
Department of Banking and Finance, Rivers State University, Port Harcourt, Nigeria
Email: ipeghaniyo@yahoo.com

Dr. EKPETE Marshall Simon
Department of Banking and Finance, Rivers State University, Port Harcourt, Nigeria

EKPETE Kinsley Simon
Department of Economics, Ignatius Ajuru University of Education, Rumuolimini, Port Harcourt, Nigeria

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Abstract

This study empirically examines the relationship between financial intermediation of commercial banks and risk in Nigeria spanning from 2007-2019 and utilizing the auto-regressive distributed lag (ARDL) approach to co-integration and Granger causality analysis. The result of the ARDL bounds test reveals a stable long run relationship between the dependent and independent variables with greater bound value of 16.02. The ARDL results also reveal the presence of short and long run positive and significant relationship between loans and advances and risk factors. The finding of the Granger causality reveals bidirectional causality between loans and advances and risk factors. The study recommends that commercial banks should continue their short term lending of credit for investment as default has been drastically reduced in lending to customers.

Keywords: Financial intermediation; Loans and advances; Total deposits; Risk factor; Information production; Borrowers and lenders.

1. Introduction

Basically the application of Auto-Regressive Distributed Lag (ARDL) bound testing approach to co-integration for the analysis of long run and short run relationship is necessary as the significant of the variables may not be affected by the order of integration of the series. Thus the ARDL approach avoids problems resulting from non-stationary time series data where series are integrated at different orders (Pesaran *et al.*, 1996).

Banks' financial intermediation role is associated with how they receive funds from depositors and provide these funds to entities that need it Bossone (2001), Fama (1985), Gorton and Winton (2002), Ham *et al.* (2004). The financial intermediary is a bank that facilitates the transfer of saved funds from surplus units to deficit units through the intermediation function of depository and lending for investment (Ezirim, 2005; Gorton and Winton, 2002). Banks plays an indispensable role of pooling together funds from the savings-surplus unit and rechanneled these resources to the deficit units (Ezirim, 2005).

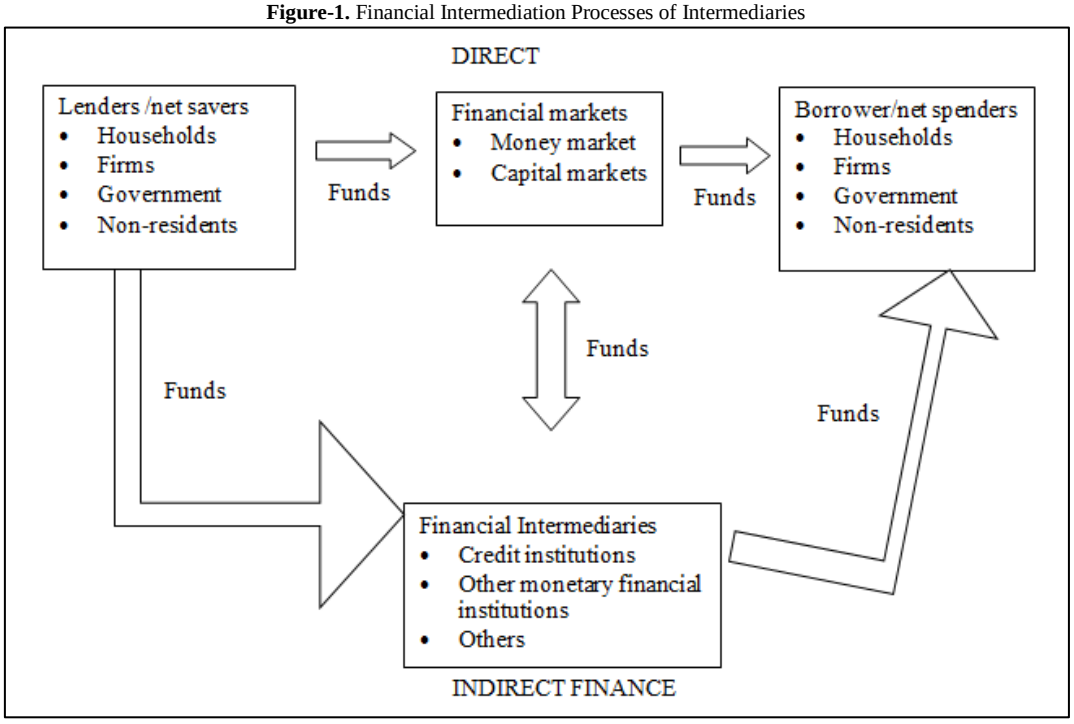
The building blocks of financial intermediation roles of banks are associated with the depositors finance, loan and advances and risk factors in banking activities. Banks offers an expanding range of products and services through their intermediation function by borrowing funds from depositors and using same to funds lending activities (Kiser, 2003). The existence of a bank lending channel relies on the premise that banks have no major source of funding other than core deposits and loans Kiser (2003). These bank-like financial intermediaries' have contributed to a deeper appreciation of the role of banks in the savings-investment process and corporate finance (Gorton and Winton, 2002).

The intermediation approach signifies that bank production role is driven by the processes used in the transformation of funds. The intermediation approach of bank production is viewed as a transformation of three input groups such as capital, operating expenses and deposits; into two output groups like loans and investments (Ashton, 1998).

Financial intermediaries are the amalgamation of institutions, tools and markets which are satisfying needs of diverse economic development (Hashmi, 2017). The contemporary literature of financial intermediation view it as a combination of financial institutions like banks, insurance companies, credit associations, leasing companies, stock market, investment banking, pension funds etc. Moreover, the banking industry is a service industry involve in performing direct and indirect financial service.

*Corresponding Author

Figure-1. Financial Intermediation Processes of Intermediaries



Source: Central Bank of Nigeria (2017), The Nigerian Financial System at a Glance, Monetary Policy Department

The Figure above describes the intermediation processes of financial intermediaries' role of collecting funds from depositors by financial institutions and lending same to borrowers. It involves the mobilization of financial savings and channeling them to borrowers through specialized institutions known as banks. These specialized institutions are also called financial markets licensed to accept those deposits and lend them to the business and households at given interest rates over a specified period. This process provides the opportunity of maturity-risk match-making. Financial intermediation also cuts across making payments, receivables, transfers and guarantees by the banks on behalf of their customers (Central Bank of Nigeria, 2017).

The growing importance of risk and the growing need of risk absorbing institutions and instruments can explain the growing importance of the financial industry to the national income. The demand for risk covering instruments grows and will continue to grow, under the increasing volatility of interest rates, stock prices and foreign exchange rates (Scholtens and Van Wensveen, 2003).

The rationale for financial risk management is the prevention of bankruptcy of a bank induced by monetary and financial factors. Financial risk management goal is to protect the bank balance sheet against severe losses of a monetary nature e.g. exchange rate shocks and the banks operational cash flow against serious financial uncertainties such as interest rate and exchange rate fluctuations and credit risk (Scholtens and Van Wensveen, 2000).

The building block of the theory of financial intermediation is directed toward understanding the existence and the behaviour of real-life financial intermediaries. The financial intermediation theory is attributed to the early studies of Akerlof (1970); Benston and Smith (1976) of transaction cost reduction, Diamond and Dybvig (1983) of liquidity assurance, Leland and Pyle (1977) of information sharing coalition and Diamond (1984), Diamond (1996) of delegated monitoring. These theories of intermediation are build on the models of resource allocation based on perfect and complete markets by suggesting that it is frictions such as transaction costs and asymmetric information that are important in understanding intermediation.

2. Research Problem

Risk management has become important in the recent past. In contrast, risk is seen as the root of financial intermediation. The banking and insurance is responsible for risk transfer and risk management function (Scholtens and Van Wensveen, 2000). Financial intermediation is in such a constant state of change unlike other areas of finance, there is an almost embarrassing lack of essential information like price data, prices of loans, of secondary loans sales that is not much of an exaggeration to say that many researchers in financial intermediation do not realize they are engaged in economic history instead of empirical study (Gorton and Winton, 2002). It is a challenge to determine whether there is important information in the financial statement which features intermediation that remains constant across time, or whether intermediation is being fundamentally altered by securitization, loan sales, credit derivatives, and other recent innovation (Gorton and Winton, 2002). It's against this backdrop that the researcher seek to investigate the significance of the banks' financial intermediation role on risk factors using the data of the ratio of total deposits, loans and advances to total assets and variance of net income as a proxy for risk factors with the intention to bring a clear relief to the tasks face by lending activity of commercial banks' in Nigeria and making appropriate policy recommendations.

This study aims to examine the effect of risk factors in the intermediation role of Nigerian commercial banks. The research question is to what extent has risk factor affects the intermediation role of commercial bank in Nigeria? Understanding these building blocks of intermediation roles of bank activity is the gap that this study is expected to

fill using the risk factors, depositors finance and loans and advances to customers. However, the study seeks to contribute to the existing studies by examining the case of Nigeria using the auto-regressive distributed lag (ARDL) approach to co-integration and granger causality to examine risk factors in the intermediation role of Nigerian commercial banks. The study also contributes by employing the variability of returns or net income as proxy for risk factor.

The paper is structure into nine sections such as section 1is the introduction stage, section 2 is research problem while 3 is the model of risk factor, next section 4 is the relationship between financial intermediation and risk factor, furthermore section 5 is the theoretical discussion of banks' financial intermediation role and risk factor, while section 6 is associated with research data and methodology, again section 7 is estimation procedure and section 8 is the empirical results and finally section 9 is the conclusion of the study.

3. Model of Risk Factor

Financial innovations are centered on risk and risk is a threat, it is the possibility of a loss, but also as an opportunity for profit (Scholtens and Van Wensveen, 2003). This study offers a unique analysis of the risk faced by financial institutions and the strategies for controlling and managing these risks. Risk is associated with default, uncertainty, unpredictability and chance of loss or no loss (Ezirim, 2005).

Consequently, risk is the possibility of an adverse deviation from a desired outcome that is expected or hope for Vaughan and Elliot (1978). Risk is always a natural phenomenon that influences the operations of economic agent such as the banks. Banks had large risk factors in the course of receiving deposits from clients and lending same as loans for investments (Onoh, 2002).

The risk factor associated with this study was derived from the application of risk index system for rating banks based on asset profitability or return on assets (Onoh, 2002). Besides the application of the Capital Adequacy, Asset Quality, Management Quality, Earnings, and Liquidity (CAMEL) system for rating banks, the risk index provides another method for assessing bank risk. The risk index developed by Federal Deposits Insurance Corporation (FDIC) in 1986 from net income and dividends returns of banks. The index (R) of a bank was presented in the following model;

$$R = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 \quad (1)$$

Where; X_1 = Primary capital to total assets (%);

X_2 = Loans and advances over due by 90 days to total assets (%);

X_3 = Non accruing loans and advances to total asset (%);

X_4 = Renegotiated loans and advances to total asset (%);

X_5 = Net loans charge-offs (annualized) to total asset (%);

X_6 = Net income (annualized) to total asset (%).

The measure is supported by three core variables, capital adequacy (X_1), loans and advances (X_2-X_5) and asset profitability or return on assets (X_6). The loan quality of a bank is a major determinant of the risk index. A bank will be regarded as healthy if its risk index lies below unity i.e., R<1. A risk index above unity i.e., R>1 indicates a problem bank (Onoh, 2002).

3.1. Earnings-at-Risk

Earnings at risk are the variance of net income because of changes in interest rates over a specified period. It is useful for investors and risk professionals to recognize the impact that a change in interest rates can make on a company's financial position and cash flow.

The earning at risk model determines the amount of capital of the bank as a whole, and at the level of individual businesses. The economic capital is derived from the observed volatility of earnings. The basic model which underlies earnings-volatility-based approaches is a definition of earnings-at-risk (EAR) using some measure of the extent to which revenues or earnings deviate either side of the mean. It was the absolute value of the change in annual net income was used as a proxy for earnings volatility (Leary and Roberts, 2005).

A generic definition of earning-at-risk is thus:

$$EAR = k\sigma r \quad (2)$$

where k is a constant, and σ_r refers to the standard deviation of the revenues or earnings of the bank.

4. Relation between Financial Intermediation and Risk Factors

According to Sharpe *et al.* (1998) financial intermediaries are institutions that are responsible for issuing financial obligations and sell them for money as assets. The banks from ancient history take deposits from households and make loans to economic agents requiring capital (Allen and Santomero, 1997). The capital generated through this procedure was further used for buying financial assets of other companies (Hashmi, 2017).

Bank has an incentive to mitigate risks, the higher the amount of capital that will be deductibles in insurance policies the better the bank's probability of default decreases with the level of capital that is buffer stock effect, and banks' stability increases with their level of capital. Also, it is arguable that capital is very costly through the issues of information anomaly and transaction cost syndrome (Bichsel and Blum, 2001). The framework of bank intermediation theory suggests that financial intermediaries make risky decision simultaneously with the perception about their expected profits and the level of bank capital and liquidity. On the other hand the more liquid or more capitalized bank will be able to take on higher risk more easily; the less liquid or less capitalized bank will have to lower its risk position (Delis *et al.*, 2014).

The roles of financial intermediaries is expressed in two dimensions as providers of liquidity while the subsequent focuses on intermediaries‟ ability to modify the risk related features of financial assets. In both dimensions, the intermediaries help in reduction of charges of allotment of funds between deficit-borrowers and surplus unit-lenders, which will lead to a more proficient allocation of resources (Hashmi, 2017).

Also (Allen and Santomero, 1998) suggest a major role of risk in the intermediation process and proposed that risk management should be identified in the study of financial intermediation. The origins of banking and insurance lie with their risk transfer and risk management function. Banks may also be concerned about volatility of earnings because low level of income may lead to insolvency (Allen and Santomero, 1999). This argument offers significant insight into why banks themselves may choose low risk strategies (Marcus, 1984; Santomero, 1989).

When the intermediation activity was not backed by information asymmetric and their eradication was not the commercial motive for financial intermediaries, the question arises which alternative could better enhance the intermediation process. The value creation has risk and the risk management as its driving force. Both banking and insurance have absorption of risk as the main function. The risk reduction function connects a disparity in between the provision of savings and the demand for investments as savings unit has more risk reluctant attitude than genuine investors. A spread out collection of investment alternatives required to protect savings unit and the policy holders by allowing financial institutions to soak up risk within the market horizon (Allen and Santomero, 1999; Hashmi, 2017; Scholtens and Van Wensveen, 2003).

5. Theoretical Discussion of Banks' Financial Intermediation Role and Risk Factors

The financial intermediation role of banks' in a broad sense means to sell financial products to economic agents in surplus and to provide credit for economic agents in deficit. However (Fama, 1985) argues that banks' can impose higher interest rate than commercial paper interest rates on companies because information can be generated about the companies through monitoring, which cannot be easily done in capital market. Also banks have a comparative advantage in producing information in comparison to the market (James, 1987; Mikkelson and Partch, 1986) found that when companies borrow from banks, their stock prices increase but if they finance in the market by issuing bonds, then stock prices may not rise. If banks' role of information production about borrowers and monitoring is strengthened, the cost of information production, monitoring and transaction will be lowered and the incentives to extend loans to sectors that have relatively higher risks will become larger. Consequently higher risk is associated with corporate lending rather than household loans.

The traditional theories of banks' financial intermediation are based on transaction cost, information production, delegated monitoring and liquidity assurance. They are originated to account for institutions which take deposits and channel funds to clients. These attributed performed by the intermediaries are identified below in the light of different theories of financial intermediation.

Accordingly Leland and Pyle (1977) provide justification of financial intermediaries as institutions which share critical information with corporate clients. This information sharing coalition provides informational advantage for corporate decision makers. However Leland and Pyle (1977) suggest that financial intermediaries might efficiently solve the reliability and suitability problems inherent with information production by issuing securities and using the proceeds to invest in a portfolio of securities which the intermediary is privately owned. The information asymmetry theory is based on the notion that the borrower is likely to have more information than the lender about the risks of the project for which they receive funds. These problems reduce the efficiency of the transfer of funds from surplus to deficit units (Gwilym, 2011; Leland and Pyle, 1977). The informational asymmetry theory is grounded on the bank relationship with the borrowers and the surplus unit in particular (Scholtens and Van Wensveen, 2003). Bank lending activity can be distinguish on transactions-based lending (financial statement lending, asset-based lending, credit scoring, etc.) and relationship lending (Berger and Udell, 2002; Kroszner and Strahan, 2001; Lehmann and Neuberger, 2001). The major activity in the borrower relation is the screening and monitoring function of banks vis-à-vis *ex ante* information asymmetries, the adverse selection problem (Akerlof, 1970), credit rationing (Stiglitz and Weiss, 1981), the moral hazard problem (Stiglitz and Weiss, 1983) and the *ex post* verification problem (Gale and Hellwig, 1985). While the other foremost activity in the surplus unit relation are bank runs, why they occur, how they can be prevented, and their economic consequences (Bernanke, 1983; Diamond and Dybvig, 1983; Kindleberger, 1989).

Also Benston and Smith (1976) provide argument that the presence of financial intermediaries help reduce the transaction cost. The transaction cost associated with financial intermediation consist of search, verification and enforcement costs (Gwilym, 2011). The transaction cost in financial literature is associated with the functions of financial intermediation in economy was introduced by Benston and Smith (1976), Campbell and Kracaw (1980), Fama (1980). The transaction costs comprise not only exchange or monetary transaction costs (Fischer, 1983; Tobin, 1963; Towey, 1974), but also search costs and monitoring and auditing costs (Benston and Smith, 1976). The transaction cost required the offer of liquidity (Pyle, 1971) and diversification opportunities (Hellwig, 1991). The provision of liquidity is a key function for savers and investors and increasingly for corporate customers, whereas the provision of diversification increasingly is being appreciated in personal and institutional financing.

However Diamond (1984) focuses on the area of delegated monitoring which enable the representatives of financial intermediary board of corporate clients' better monitor and control mechanism for borrowers. Also (Diamond, 1984) intermediaries ‘‘monitor’’ borrowers on behalf of investors who lend to the intermediary. In (Diamond, 1984) borrowers must be monitored because there is an ex posts information asymmetry in that lenders do not know how much the firm has produced. Monitoring result to increasing returns to scale, which implies that

specializing, may be attractive. He identified the activity of financial intermediary as agents of several investors and delegate authorities on monitoring of credit contracts. This has several advantages for creditors for the reason that otherwise they had exhausted their efforts on monitoring and wasted limited resources. Thus, it is profitable for creditors to use an intermediary that can save their money spent on monitoring in comparison with direct financing (Hashmi, 2017).

Banks as Liquidity providers has been studies by numerous scholars suggesting that one of reasons for banks existence is to supply liquidity to borrowers and lenders (Diamond and Dybving, 1986; Diamond, 2007; Gatev and Strahan, 2006; Gorton and Pennacchi, 1990; Holmstrom and Tirole, 1998; Kashyap *et al.*, 2002; Lewis, 1992; Rajan, 1996; Tirole *et al*., 2010). Furthermore (Diamond and Dybving, 1986) discuss that the role of banks was to create liquidity, thus banks fulfill valuable activities on both sides of their balance sheets by granting loans to borrowers and providing liquidity on demand to depositors. Banks usually fulfill their liquidity provision function by granting long-term and illiquid loans to borrowers by using short-term and liquid deposits. By offering these services jointly, banks can provide liquidity services to customers and investors who are uncertain about the timing of their future consumption need (Diamond and Dybving, 1986; Lewis, 1992). Also Holmstrom and Tirole (1998) argue that a key function of a financial intermediary is to provide liquidity in the form of loan commitments. As Kashyap *et al.* (2002) emphasize that banks provide liquidity through loan commitments or credit lines. Loan commitments can give a borrower the option to draw down their loan amount on demand during the period of the contract. These withdrawals are uncertain to the bank. From the perspectives of customers, loan commitments provide liquidity, like demand deposits, whenever they require liquidity unexpectedly.

Deposit insurance is considered the most effective measure to prevent runs without preventing banks from creating liquidity, and, consequently, bank policy issues should be considered in the context of deposit insurance (Diamond and Dybving, 1986). It has been shown that deposit insurance enables banks to meet increased credit demand and synchronized draw-downs during episodes of market stress (Gatev and Strahan, 2006).

Delis *et al.* (2014), studies on the risk of financial intermediaries and employ bank risk proxy of variability of the profit function where this variability is endogenous to other bank characteristics like capital and liquidity. Other literature employs the variation on returns or profits as a more comprehensive risk metric as Mitchell (1982), Mitchell (1986) is probably the first to theoretically use the variance of returns or the variance of returns scaled by their mean (i.e., the coefficient of variation) is a valuable risk metric in banking, following directly from the theoretical considerations of (Markowitz, 1952; Roy, 1952).

Most of the empirical studies uses information from a fixed number of periods to calculate the variance of return on assets, σ(ROA), or the coefficient of variation as a measure of bank risk (Chiorazzo *et al.*, 2008; Delis and Tsionas, 2012; DeYoung and Rice, 2004; Fang and Marton, 2011; Jiménez *et al.*, 2013; Lepetit *et al.*, 2008; Stiroh, 2004; Stiroh and Rumble, 2006).

6. Data and Methodology

6.1. Data Description

The data employed are secondary in nature of 13 commercial banks listed on the Nigerian Stock Exchange published of various issues of annual reports spanning from 2007-2019.

Table-1. Commercial Banks

Fidelity Bank Plc
First City Monument Bank Plc
Ecobank Plc
Access Bank Plc
First Bank Of Nigeria Plc
Guaranty Trust Bank Plc
Stanbic IBTC Bank Plc
Sterling Bank Plc
United Bank For Africa
Union Bank Of Nigeria
Unity Bank Plc
Wema Bank Plc
Zenith Bank Plc

Source: Central Bank of Nigeria (2017) and Nigeria Stock Exchange (NSE) fact book and the World Wide Web – Internet

6.2. Model Specification

The study model was design to illustrate the effect of intermediation role of commercial banks, which classified deposits as bank input and loans as output. In the intermediation approach of modeling bank production, banks depositors' funds are transformed into loan funds, which form the principal output from banks (Ashton, 1998). Commercial banks risk factor was proxy for earnings volatility (Delis *et al.*, 2014). The researcher adopted and modified the model of Delis *et al.* (2014), Kiser (2003) to agree with this study.

The equation below shows the functional and econometric relationship between the variables of the study;

$$\sigma(RF)/RF = f\,(TD/TA, TL/TA) \quad (3)$$

The econometric equation for the model is specifies as;

$$\text{Risk factor } \frac{\sigma(RF)}{RF} = \beta_0 + \beta_1 \frac{TD}{TA} \text{ total deposit to total assets }_t + \beta_2 \frac{LA}{TA} \text{ loan and advances to total assets }_t + \mu \quad (4)$$

Where;
RF: Earnings volatility proxy for Risk Factor for bank i^{th} in year t.
TD: Total Deposits for bank i^{th} in year t.
LA: Loan and advances for bank i^{th} in year t.
TA: Total assets for bank i^{th} in year t.
β_0 = Constant parameter/Intercept
β_1- β3 = Coefficients of independent variables
μ = Error term

The 'a priori expectation' in the model is that all the independent variables are expected to have a positive relationship on risk factor measured by the absolute value of the change in annual net income is used as a proxy for earnings volatility.

The mathematical expression is represented as; $\beta_0 < 0$, $\beta_1 > 0$, and $\beta_2 > 0$ implying that a unit increase in the independent variables will lead to decrease in Risk Factor by a unit.

6.3. Variable Construction

6.3.1. Risk Factor

Bank's financial intermediation role is affected by business structural factors such as default risks. However, Abbas *et al.* (2016) state the implication of profit variability, whether it is considered due to the inherent business risk or as a result of inefficient management practices, or earnings volatility is a proxy for the probability of financial losses, and the interest rate paid on loans and advances to banks increase because such banks will have to pay premium in order to minimize the risk of outside funds providers. Higher variability in earnings indicates that the probability of bankruptcy increases; we can expect that banks with higher income variability will be default in supply of loans and advances. Also (Rafiq *et al.*, 2008) used the value of the deviations from mean of net income divided by total number of years for each firm in the given year as a proxy for earnings volatility. However Leary and Roberts (2005) used the absolute value of the change in annual net income as a proxy for earnings volatility. As a result this study used risk factor as the absolute value of the change in annual net income and proxy earnings volatility. Income variability is a measure of business risk.

6.3.2. Loans and Advance

The study employs the ratio of total loans and advances to total assets. The total loans and advances show the percentage of loan and advances in relation to total assets. Total loans and advances show the bank market power in the provision of credits. Increase in total loans and advances will result to risk increases (Moussa, 2015). Loans and advances constitute a major source of income and risk assets to banks. Advances may include loans for a fixed period made to firms and individuals, and overdraft where the borrower can withdraw his account.

6.3.3. Deposits

The bank intermediation roles involve the ratio of total deposits to total assets. Total deposits show the share of deposits relative to total assets. The deposits forms the bulk of the liabilities of commercial banks, they includes demand deposits, time deposits and saving deposits. The deposits are used to finance credit operation (Moussa, 2015). Total customers deposits represent the raw material which banks use for meeting their intermediation function. It is obvious that commercial banks primary business is characterized by securing funds from depositors and using these deposit funds to make commercial and consumer loans.

Table-2. Definitions of Selected Variables for financial Intermediation roles and Risk Factor

Variable	Symbol	Definitions	Expected sign
Dependent Variable			
Risk Factor	RF	Earnings volatility is the absolute value of the change in annual net income is a proxy for Risk factor	(-)
Independent Variables			
Total Deposit	TD	Total deposits to total assets. Total deposits show the share of deposits relative to total assets. The deposits are used to finance credit operation.	(+)
Loan and Advance	LA	Total loan and advances to total assets. The total loans and advances show the percentage of loan and advances in relation to total assets. Total loan and advances shows the bank market power in the provision of credits. Increase in total loan and advances, the risk increases.	(+)

Source: Authors' Description, 2021

7. Estimation Procedure

The equation (4) forms the basis of our estimation. The econometric analysis of model (4) confronts the following issues: First, we test for stationarity using a unit root test for balanced panel data. Second, we use auto-regressive distributed lag (ARDL) techniques to estimate co-integration and error correction mechanism analysis such that the estimation of the long-run variables and then residuals are converted and inserted as an error correction term in the model.

7.1. Unit Root Test

Time-series data is often found to be non-stationary, containing a unit root. Therefore, we start our analysis with unit root testing for all the panel data variables. Augmented Dickey Fuller (ADF) method was used (Heij *et al.*, 2004; Nielsen, 2005) for this purpose. Applying ADF, we have to check whether the particular variables have unit root or not. The hypotheses are as follows:

H_0: variables are not stationary or have unit root; alternative hypothesis H_1: variables are stationary.

ADF checks the hypothesis about the stationarity of the particular variables at significance levels of 1%, 5% and 10%.

7.2. Auto-Regressive Distributed Lag (ARDL) Technique

This study employs the Autoregressive Distributed Lag (ARDL-Bounds) testing approach to co-integration proposed by Pesaran *et al.* (2001). The ARDL approach offers some desirable statistical advantages over other co-integration techniques. While other co-integration techniques require all the variables to be integrated of the same order, ARDL test procedure provides valid results whether the variables are I(0) or I(1) or mutually co-integrated and provides very efficient and consistent test results in small and large sample sizes (Pesaran *et al.*, 2001). The small number of observations and the different order of integration make ARDL the preferred approach in this study.

Recall that the basic form of an ARDL model is:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \ldots\ldots + \beta_k y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_1 x_{t-2} + \ldots\ldots + \alpha_q x_{t-q} + \square_t \quad (5)$$

Where ε_t is the random disturbance term which is serially independent and assumed to be well behaved or constant.

The Autoregressive Distributive Lag model is considered as an ARDL (p q) model whose reduced form is presented as:

$$_{Y_{t-}}\mu + \sum_{i=0}^{p} \alpha_t \Delta Y_{t-1} + \sum_{i=0}^{q} \beta_1 \Delta X_{t-1} + \square_t \quad (6)$$

Where, Y_t is the dependent variable with its lags as independent variables. X_t is the lagged independent variables and ϵ_t being the white noise. Generally, using the lag operator L applied to each component of a vector.

A detail specification of the model with respect to the variables of this study is presented below.

$$\Delta \text{Risk Factor}_t = \beta_0 + \sum_{i=0}^{p} \beta_{1t} \Delta \text{Risk Factor}_{t-1} + \sum_{i=0}^{p} \beta_{2t} \Delta \text{Total Deposits}_{1t-1} + \sum_{i=0}^{p} \beta_{3t} \Delta \text{Loans and Advances}_{2t-1} + \beta_4 \text{Risk Factor}_{t-1} + \beta_5 \text{Total Deposits}_{t-1} + \beta_6 \text{Loans and Advances}_{t-1} + \square_{1t} \quad (7)$$

Where Δ refers to the first difference operator and ε_t being the error term. The test involves conducting F-test for joint significance of the coefficient of lagged variables for the purpose of examining the existence of a long-run relationship among the variables. The null hypothesis of no long-run relationship existing between the variables (Ho: $\beta 4 = \beta 5 = \beta 6 = 0$) is examined following (Pesaran *et al.*, 2001).

The decision to reject or accept Ho is based on the Following conditions: if F-value > upper bound, then reject Ho and the variables are co-integrated, if F-value < lower bound, then accept Ho and the variables are not co-integrated, but if F-value ≥ lower bound and ≤ upper bound, then the decision is inconclusive.

The error correction model for the estimation of the short run relationships is specified as:

$$\Delta \text{Risk Factor}_t = \beta_0 + \sum_{i=0}^{p} \beta_{1t} \Delta \text{Risk Factor}_{t-1} + \sum_{i=0}^{p} \beta_{2t} \Delta \text{Total Deposits}_{1t-1} + \sum_{i=0}^{p} \beta_{3t} \Delta \text{Loans and Advances}_{2t-1} + \lambda t \, ECM_{t-1} + \mu_{1t} \quad (8)$$

A negative and significant ECM_{t-1} coefficient (λ_1) implies that any short term disequilibrium between the dependent and explanatory variables will converge back to the long-run equilibrium relationship.

7.3. Granger Causality

The simplest test for Granger causality requires estimating the following two regression equations:

$$yt = \beta_{1,0} + \sum_{i=1}^{p} \beta_{1,i} \, y_{t-i} + \sum_{j=1}^{p} \beta_{1,p+j} \, x_{t-j} + \square_{1t} \quad (9)$$

$$yt = \beta_{2,0} + \sum_{i=1}^{p} \beta_{2,i} \, y_{t-i} + \sum_{j=1}^{p} \beta_{2,p+j} \, x_{t-j} + \square_{1t} \quad (10)$$

where p is the number of lags that adequately models the dynamic structure so that the coefficients of further lags of variables are not statistically significant and the error terms □ are white noise. If the p parameters $\beta_{1,p+j}$ are jointly significant then the null that x does not Granger cause y can be rejected. Similarly, if the p parameters $\beta_{1,i}$ are jointly significant then the null that y does not Granger cause x can be rejected. This test is usually refereed to as the Granger causality test (Stern, 2011).

8. Empirical Results

In analyzing the relationship between financial intermediation and risk factor in Nigeria, this section begins with preliminary test for stationarity of the variables via Augmented Dickey-Fuller (ADF) unit root test, the result is presented in table 3 below:

Table-3. Unit root test

Variables	Augmented Dickey Fuller Statistics	Critical level at 0.05	Decision
Risk factor	-11.59295	-2.878723	1(1)
Total Deposit	-10.80203	-2.879045	1(1)
Loans and Advances	-11.60747	-2.878723	1(1)

Source: Author's computation using EVIEWS software

The results above shows all the variables are integrated in the same order. This means that all the variables become stationary at first difference thus, they are integrated of order one i.e. 1(1). It is therefore imperative to test for the presence of co-integration using the bound test.

8.1. Bound F-Test for Co-Integration

After the achievement of stationarity, the next step is to conduct bound F-test for co-integration in equation (7) in order to establish a long-run relationship among the series variables. The results of the bound F-test for co-integration together with the asymptotic critical values are presented below in Table 4,

Table-4. Bound F-Test for Co-Integration Estimates

ARDL Bounds Test		
Date: 07/21/20 Time: 17:26		
Sample: 2 169		
Included observations: 168		
Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	16.02242	2
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Source: Author's computation using EVIEWS software

The decision rule is that if the computed F-statistic falls below the lower bound we would conclude that the variables are 1(0), so no co-integration is possible, by definition. If the F-statistic exceeds the upper bound, we conclude that we have co-integration. Finally, if the F-statistic falls between the bound, the test is inclusive (Pesaran *et al.*, 2001).

From the results since the calculated F-statistic (16.02) is greater than the upper bound (4.85) at 5% level of significance, we reject the hypothesis. We therefore accept the present of long run relationship among the variables.

8.2. Long-Run and Short Run Estimates

The estimated long-run coefficient of the three ARDL specifications is presented in Table 5 below:

Table-5. ARDL Coefficients For Long Run

Variables	Coefficient	Std. Error	T-statistic	Prob.
Total deposits	-19052.0	22859.6	0.4058	0.4058
Loans and advances	17158.0	48296.0	0.0005	0.0005
c	-42885.6	36679.0	0.2441	0.2441

Source: Author's computation using EVIEWS software 9.0 output

The long run table above shows a negative and insignificant relationship between total deposits and risk factor. The increase of total deposits has a negative effect on risk factors. However, more volatile net income increases the probability of default, implying a negative relationship between total deposits and risk factors. This means that total deposits of banks was affected by risk factors in the mobilization of funds from the surplus to the deficit sector for investment activity. Also the low deposits and risk factors may weaken the intermediation role of banks of lending credit to customers.

The regression table below also reveals a negative and significant relationship between total deposits and risk factors in the short run in Table 6. This shows that the increase in total deposits will negatively impact risk factors. This will strongly result to low deposits ratio that may be available to banks for their intermediation function of lending credits to households and corporate bodies.

From the long run estimates above, there is a positive and significant relationship between loans and advances and risk factors. An increase in loans and advances has a positive effect on risk factors. The high credit growth will increase the number of borrowers default which increasing the bank risk factors. This agree with the study of Salkeld and Shim (2011).

The loans and advances has a positive and significant relationship with risk factor in the short run in table 6, this means that there will be increase in the supply of loan and advances in the intermediation role of banks as this would stimulates the bank market power in the provision of credits. The increase in the supply of loan and advances will result to risk increases (Moussa, 2015).

Table-6. Short Run Error Correction Estimates

Dependent Variable: RF(-1)				
Method: Least Squares				
Date: 07/21/20 Time: 17:46				
Sample (adjusted): 3 169				
Included observations: 167 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.238117	1.334954	0.927461	0.3551
TD(-1)	-3.12E+12	0.014039	-2.22E+14	0.0000
LA(-1)	5.02E+15	3.364688	1.49E+15	0.0000
RF(-2)	-6.61E-15	5.36E-16	-12.33017	0.0000
TD(-2)	-0.021016	0.014132	-1.487118	0.1390
LA(-2)	-0.733501	2.294670	-0.319654	0.7496
ECM(-1)	1.000000	5.56E-16	1.80E+15	0.0000
R-squared	1.000000	Mean dependent var		6.01E+15
Adjusted R-squared	1.000000	S.D. dependent var		8.11E+15
S.E. of regression	12.36796	Akaike info criterion		7.909107
Sum squared resid	24474.62	Schwarz criterion		8.039802
Log likelihood	-653.4105	Hannan-Quinn criter.		7.962153
F-statistic	1.19E+31	Durbin-Watson stat		2.220554
Prob(F-statistic)	0.000000			

Source: Author's computation using EVIEWS software

The error correction mechanism (ECM) is used to verify the short run relationship between total deposits, loans and advances and risk factor. The rule for the existence of a short run relationship between financial intermediation role of banks and risk factor is that the coefficient of the error correction term should be negative and statistically significant. Our results below do not confirms this, thus we can conclude that the parameter of error correction term as shown in the table is positive and significant. This suggests that long run equilibrium condition does not influence the short run dynamics in Nigeria and that there is not automatic adjustment mechanism that is the intermediation role does not respond to deviations from equilibrium.

The Prob. (F-statistics) is 0.00000, implying that all the variables significantly influence the intermediation role of banks and risk factor. Durbin Watson has a value of 2.22, indicating the absence of auto-correlation.

8.3. Granger Causality Test

This test is employ to ascertain the direction of causality between financial intermediation role of banks and risk factor in Nigeria. Table 7 below presents the results of granger causality test:

Table-7. Granger Causality Estimates

Pairwise Granger Causality Tests			
Date: 07/21/20 Time: 18:00			
Sample: 1 169			
Lags: 5			
Null Hypothesis:	Obs	F-Statistic	Prob.
TD does not Granger Cause RF	164	0.03093	0.9995
RF does not Granger Cause TD		0.85040	0.5161
LA does not Granger Cause RF	164	18.0813	5.E-14
RF does not Granger Cause LA		4.02044	0.0019
LA does not Granger Cause TD	164	0.05589	0.9980
TD does not Granger Cause LA		0.07723	0.9956

Source: Author's computation using EVIEWS software

The Granger Causality test results reveals a bidirectional causality between loans and advances and risk factor, with their high F-statistics value of 18.08130 and 4.02044 and low probability of 1% and 5% level of significance respectively. Therefore, the null hypothesis of no causation between loans and advance and risk factor is rejected. This shows the relationship between loans and advances and risk factor as the increase in loans and advances has a

positive effect on risk factor. The credit growth can increase the number of borrowers default which increasing risk factor. This agrees with the result of Salkeld and Shim (2011).

8.4. Diagnostic Test

To verify the presence of serial correlation in the model, the Breusch-Godfrey serial correlation LM test is applied. If the probability is significance at 5% level, the null hypotheses is accepted and conclude that the model has a serial correlation, but if it is not significant at 5% level, the null hypothesis is rejected and concluded that the model has no serial correlation.

Table-8. Breusch-Godfrey Serial Correlation LM Test

F-statistic	**1.087399**	**Prob. F(2,160)**	**0.3396**
Obs*R-squared	2.252916	Prob. Chi-Square(2)	0.3242

Source: Author's computation using EVIEWS software

The test for the existence of serial correlation using the Breusch-Godfrey serial correlation LM test in Table 8 above reveals that there is no evidence of serial correlation and that our model is good. Therefore the null hypothesis is rejected and concludes that the model has no presences of serial correlation.

9. Conclusion

This study empirically examined the effect of financial intermediation role of commercial banks and risk factors in Nigeria over the period 2007-2019 using the unit root, auto-regressive distributed lag (ARDL) approach to co-integration and granger causality analysis, controlling for the possible effects of loans and advances, total deposits and bank risk factors in Nigeria. The results from this study shows that all variables, included in the model were integrated in their first difference that is 1(1). It equally shows that there exist co-integration between financial intermediation function and bank risk factors; there is both long and short run relationship between loans and advances and bank risk factors in the study. In addition, the Granger causality has bidirectional causality between loans and advances and bank risk factor. This mean that by increasing the supply of loans and advances to customers, the financial intermediation function of lending for investment will be enhance in the economy. The study recommends that commercial banks should continue their short term lending of credit for investment as default has been drastically reduced in lending to customers.

Competing Interests

The author has declared that no competing interests exist.

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Appendix

COMMERCIAL BANKS AND DATA SET

FIDELITY BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	217145	70238	4160	29757
2008	533122	230713	12987	135864
2009	434053	176398	1414	129340
2010	497453	207491	5828	154383
2011	737732	280421	3911	152340
2012	914360	345500	17924	162033
2013	1081217	426076	7721	163455
2014	1187025	541686	13796	173125
2015	1231722	578203	13904	183516
2016	1298141	718401	9734	792971
2017	1379214	768737	18857	775276

2018	1719883	849880	22926	979413
2019	2114037	1126974	28425	1225213
FIRST CITY MONUMENT BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	467337030	381382275	15109091	277454178
2008	515601585	436248852	3994543	348235220
2009	463641243	360518291	564338	279693815
2010	538590882	384211268	7934971	335401976
2011	601616494	323353706	7682216	410683355
2012	908545756	357798798	15121704	646268767
2013	1008280170	450532965	15932899	715214192
2014	1169364784	617979790	22065147	738593548
2015	1159534176	592957417	4676101	705677744
2016	131366185	659937	3730260	682407
2017	131636805	649797	1524886	696216
2018	132792066	633034	3552392	860887
2019	133165561	717533	3030341	1143683
ECOBANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	311396	200323	7450	231485
2008	432466	307384	5	334627
2009	355662	256980	4588	260978
2010	10466871	5264184	131819	7924585
2011	17161912	7359940	206840	12076495
2012	19939383	9440945	286732	14620478
2013	22532453	11421605	147773	16489904
2014	24243562	12311642	394770	17436970
2015	23553919	11200349	107464	16427553
2016	20510974	10673073	204958	15519072
2017	22431604	11043670	228534	16975685
2018	8195043205	39356113	77463917	63373310
2019	8621939805	40731508	99461946	67300691
ACCESS BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	1031842021	244595621	16054464	423741828
2008	674865041	391688687	22185794	436168354
2009	647574719	360387649	880752	444861775
2010	726960580	403178957	12931441	475285053
2011	949382097	491653266	5248866	654416428
2012	1515754463	557646719	35815611	1110291736
2013	1704094012	748349392	26211844	1278472145
2014	1981955730	1075685685	39941126	1459310273
2015	2411944061	1303630030	65868773	1591557668
2016	3094961	1698569	64026	1908165
2017	3499684	1872712	53239	2186915
2018	3968115	1782755	73596	2675384
2019	6311041	2646037	73569	4747624
FIRST BANK OF NIGERIA				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	1165461	437768	18835	705905
2008	1667422	684107	35074	1150816
2009	1772456	1022486	1275	1309117
2010	1962444	1017411	32123	1385936
2011	2463543	1128851	47462	1835028
2012	270977	1715	819	2484570
2013	311811	1549	70631	3011113
2014	287770	3341	5683	3222004
2015	282831	4855	2180	3115574
2016	4736805	1135036	12243	3520299
2017	5236537	1384810	40011	3808704
2018	5568909	1516770	58232	4236006
2019	6203526	1780235	73665	4880322
GUARANTEE TRUST BANK				

Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	732038458	288170430	21169477	363261237
2008	959183693	416342475	35820915	498571009
2009	1066503718	563494234	23686843	698062607
2010	1152001900	593572400	38346623	779138714
2011	1523527545	679517535	51653251	984122534
2012	1620317223	742614929	85263826	1061292894
2013	1904365795	926984069	85545510	1262815764
2014	2126608312	1182424689	89170777	1439665783
2015	2277629224	1265846260	94308123	1422590066
2016	2613340	1447161	126837	1721623
2017	2824929	1309452	161285	1739921
2018	2712521	1114073	166753	2601745
2019	3097248	1373272	175125	2102010
STANBIC IBTC BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	304394	103271	6942	139307
2008	345206	120344	9214	181116
2009	331000	177705	6258	208745
2010	372612	209970	7811	192350
2011	542272	302771	4048	299787
2012	72508	290915	1053	382051
2013	75401	383927	8332	468038
2014	75671	407418	13136	554056
2015	76210	419678	14034	593261
2016	92857	368229	609	614735
2017	97374	381711	25165	815363
2018	107952	441261	15499	967964
2019	126886	535170	33727	886743
STERLING BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	145974674	45957835	620658	106933727
2008	236302923	65787520	6523153	184730727
2009	205640827	78140098	6660406	160620381
2010	259579523	99312070	4178493	199274284
2011	504048213	162063156	6908598	409794177
2012	580225940	229420874	6953539	466845100
2013	707797181	321748748	8274864	570511097
2014	824539426	371246273	9004973	655944127
2015	799451417	338726271	10292577	590889216
2016	745123	468250	7295	608503
2017	965905	898073	17210	695882
2018	1085876	621017	6215	761013
2019	1165509	618732	21319	892861
UNITED BANK FOR AFRICA				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	1102348	320229	19831	897651
2008	1520091	405540	40002	1290036
2009	1400879	543289	12889	1161166
2010	1432632	569312	2167	1119114
2011	1666053	594090	7966	1239919
2012	1933065	598592	47375	1484006
2013	2217417	823193	46483	1797376
2014	2338858	933578	40083	1813803
2015	2216337	837285	47642	1627410
2016	2539585	1114205	74437	30798
2017	2931826	1193188	58106	15413
2018	3591305	1229317	29038	2454610
2019	4136493	1603229	110994	2857105
UNION BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	907074	244845	5009	712074
2008	1106779	401546	4134	851603

2009	921230	336812	798	803791
2010	845231	178654	70578	630951
2011	827153	144358	76711	401355
2012	886468	136982	3170	485505
2013	882097	210118	5121	483156
2014	920230	302372	20486	525486
2015	998137	348984	17721	580916
2016	1123483	489890	15885	638178
2017	1334921	488555	12859	807394
2018	1324297	428037	18438	844413
2019	1711739	550613	24375	886328
UNITY BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	203234002	84141143	720843	145793517
2008	364080837	208816058	13242136	320139525
2009	256798086	140538178	15855855	214820710
2010	304044730	148410857	12415472	222145561
2011	372926748	178909487	2693859	266877426
2012	395720179	202628232	6180061	270060046
2013	403629290	202614700	22582339	303270560
2014	413305111	235493706	10692476	277025613
2015	443321012	264722475	4689157	271971983
2016	492681647	277214521	2183798	314391506
2017	156506503	8958126	1646291	295268311
2018	1090505	891594	4157	977658
2019	1222335	984044	4250	1098067
WEMA BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	128906575	55180566	57738739	136122027
2008	110981613	59229615	11668408	108907683
2009	142785723	87366049	2094692	95258871
2010	203144627	93901057	16238533	124096118
2011	221157042	67236605	4228926	150045576
2012	245704597	73745715	5040629	175033280
2013	330872475	98631825	1596531	221131929
2014	382562312	149293849	2372445	262199696
2015	396743314	185596590	2327275	284977863
2016	421221	227009	2437844	320762
2017	385388	215840	2441209	281062
2018	477916	252190	3359259	369314
2019	704956	289240	5210748	580922
ZENITH BANK				
Years	Total Assets	Loans and Advances	Net Income	Total Deposits
2007	883941	218306	17509	568012
2008	1680032	417073	46524	1164460
2009	1573196	669261	18365	1111328
2010	1789458	667860	33335	1289552
2011	2169073	827035	41301	1577290
2012	2436886	895354	95803	1802008
2013	2878693	1126559	83414	2079862
2014	3423819	1580250	92479	2265262
2015	3750327	1849225	98784	2333017
2016	4283736	2138132	119285	2552963
2017	4833658	1980464	157145	2744525
2018	4955445	1736066	166939	2821066
2019	5435073	2239472	191873	3486887

Variables Construction

Risk Factor (Variance of Net Income)	**Total Deposit/Total Assets**	**Loans and Advances/ Total Assets**
1.0875	1.9158	0.3235
1.0922	2.4360	0.4328
1.0970	0.3258	0.4064

1.1018	1.1716	0.4171
1.1067	0.5301	0.3801
1.1116	1.9603	0.3779
1.1165	0.7141	0.3941
1.1214	1.1622	0.4563
1.1264	1.1288	0.4694
1.1315	0.7498	0.5534
1.1365	1.3672	0.5574
1.1417	1.3330	0.4941
1.1468	1.3446	0.5331
1.1520	3.2330	0.8161
1.1590	0.7747	0.8461
1.1648	0.1217	0.7776
1.1719	1.4733	0.7134
1.1781	1.2769	0.5375
1.1825	1.6644	0.3938
1.1758	1.5802	0.4468
1.1641	1.8869	0.5285
1.1502	0.4033	0.5114
1.1384	2.8396	0.0050
1.1443	1.1584	0.0049
1.1503	2.6752	0.0048
1.1563	2.2756	0.0054
1.1625	2.3925	0.6433
1.1686	0.0012	0.7108
1.1748	1.2900	0.7225
1.1811	1.2594	0.5029
1.1876	1.2052	0.4289
1.1943	1.4380	0.4735
1.2011	0.6558	0.5069
1.2080	1.6283	0.5078
1.2150	0.4562	0.4755
1.2221	0.9993	0.5204
1.2292	1.0188	0.4923
1.2365	0.9453	0.0048
1.2448	1.1536	0.0047
1.2534	1.5559	0.2370
1.2587	3.2874	0.5804
1.2637	0.1360	0.5565
1.2682	1.7788	0.5546
1.2714	0.5529	0.5179
1.2632	2.3629	0.3679
1.2018	1.5382	0.4391
1.1097	2.0152	0.5427
9.7782	2.7309	0.5405
8.1082	2.0687	0.5488
8.1612	1.5213	0.5351
8.2148	1.8547	0.4493
8.2692	1.1657	0.4193
8.3248	1.6161	0.3756
8.3801	2.1035	0.4103
8.4361	0.0719	0.5769
8.4929	1.6369	0.5184
8.5504	1.9266	0.4582
8.6087	0.3022	0.0063
8.6680	22.6519	0.0050
8.7281	1.9748	0.0116
8.7890	0.7708	0.0172
8.8506	0.2585	0.2396
8.9131	0.7641	0.2645
8.9766	1.0457	0.2724
9.0409	1.1875	0.2870
9.1062	2.8919	0.3937

9.1536	3.7345	0.4341
9.1267	2.2210	0.5284
8.9170	3.3287	0.5153
8.5992	3.3904	0.4460
7.9533	5.2622	0.4583
7.1359	4.4921	0.4868
5.8417	4.1931	0.5560
4.0248	4.1406	0.5558
2.1783	4.8534	0.5538
2.1945	5.7093	0.4635
2.2110	6.1475	0.4107
2.2278	5.6542	0.4434
2.2447	2.2806	0.3393
2.2615	2.6691	0.3486
2.2784	1.8906	0.5369
2.2956	2.0963	0.5635
2.3129	0.7465	0.5583
2.3305	1.4523	4.0122
2.3482	11.0503	5.0918
2.3661E+16	17.3594	5.3841
2.3843E+16	18.4149	5.5069
2.4026E+16	0.6558	3.9655
2.4212E+16	25.8437	3.9201
2.4399E+16	14.3573	4.0876
2.4589E+16	26.5806	4.2177
2.4780E+16	0.4252	0.3148
2.5106E+16	2.7605	0.2784
2.5345E+16	3.2389	0.3800
2.5637E+16	1.6097	0.3826
2.5848E+16	1.3706	0.3215
2.4834E+16	1.1984	0.3954
2.3190E+16	1.1691	0.4546
2.0148E+16	1.0921	0.4502
1.5584E+16	1.2875	0.4237
1.1812E+16	0.9790	0.6284
1.1924E+16	1.7817	0.9298
1.2039E+16	0.5723	0.5719
1.2154E+16	1.8292	0.5309
1.2272E+16	1.7990	0.2905
1.2391E+16	2.6316	0.2668
1.2512E+16	0.9201	0.3878
1.2635E+16	0.1513	0.3974
1.2758E+16	0.4781	0.3566
1.2883E+16	2.4508	0.3097
1.3010E+16	2.0963	0.3712
1.3139E+16	1.7138	0.3992
1.3269E+16	2.1496	0.3778
1.3400E+16	2.9311	0.4387
1.3526E+16	1.9819	0.4070
1.3652E+16	0.8086	0.3423
1.3787E+16	2.6833	0.3876
1.3922E+16	0.5522	0.2699
1.4051E+16	0.3735	0.3628
1.4179E+16	0.0866	0.3656
1.4305E+16	8.3501	0.2114
1.4429E+16	9.2741	0.1745
1.4550E+16	0.3576	0.1545
1.4668E+16	0.5805	0.2382
1.4782E+16	2.2262	0.3286
1.4891E+16	1.7754	0.3496
1.4994E+16	1.4139	0.4360
1.5091E+16	0.9633	0.3660
1.5180E+16	1.3923	0.3232

1.5258E+16	1.4240	0.3217
1.5325E+16	0.3547	0.4140
1.5713E+16	3.6371	0.5735
1.4941E+16	6.1744	0.5473
1.5037E+16	4.0834	0.4881
1.5070E+16	0.7224	0.4797
1.4683E+16	1.5617	0.5120
1.4185E+16	5.5948	0.5020
1.3163E+16	2.5871	0.5698
1.2344E+16	1.0577	0.5971
1.1451E+16	0.4432	0.5627
9.7116E+15	1.0519	0.0572
8.0358E+15	0.3812	0.8176
8.2211E+15	0.3477	0.8051
8.4118E+15	44.7912	0.4281
8.5176E+15	10.5138	0.5337
8.7703E+15	1.4670	0.6119
9.0953E+15	7.9936	0.4622
9.2846E+15	1.9122	0.3040
9.2344E+15	2.0515	0.3001
8.8035E+15	0.4825	0.2981
7.3694E+15	0.6201	0.3902
4.4619E+15	0.5866	0.4678
1.0024E+12	578.7565	0.5389
9.5174E+11	633.4419	0.5601
8.6864E+11	702.8974	0.5277
7.7073E+11	739.1593	0.4103
6.8255E+11	1.9808	0.2470
5.4704E+11	2.7692	0.2483
5.0579E+11	1.1674	0.4254
4.2041E+11	1.8629	0.3732
3.3248E+11	1.9041	0.3813
2.6934E+11	3.9314	0.3674
2.1857E+11	2.8976	0.3913
1.9622E+11	2.7010	0.4615
1.8842E+11	2.6340	0.4931
1.6509E+11	2.7846	0.4991
1.6671E+11	3.2511	0.4097
2.2166E+11	3.3688	0.3503
#DIV/0!	3.5303	0.4120

ADF UNIT ROOT TEST @ RISK FACTOR FIRST DIFFERENCING

Null Hypothesis: D(RF) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=13)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-11.59295	0.0000
Test critical values:	1% level		-3.469691	
	5% level		-2.878723	
	10% level		-2.576010	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(RF,2)				
Method: Least Squares				
Date: 07/21/20 Time: 17:13				
Sample (adjusted): 3 169				
Included observations: 167 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RF(-1))	-0.897782	0.077442	-11.59295	0.0000
C	-1.36E+08	1.53E+14	-8.89E-07	1.0000
R-squared	0.448891	Mean dependent var		-1.33E+09
Adjusted R-squared	0.445551	S.D. dependent var		2.65E+15
S.E. of regression	1.97E+15	Akaike info criterion		73.28661

Sum squared resid	6.42E+32	Schwarz criterion	73.32396
Log likelihood	-6117.432	Hannan-Quinn criter.	73.30177
F-statistic	134.3964	Durbin-Watson stat	2.009712
Prob(F-statistic)	0.000000		

TOTAL DEPOSIT

Null Hypothesis: D(TD) has a unit root				
Exogenous: Constant				
Lag Length: 3 (Automatic - based on SIC, maxlag=13)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-10.80203	0.0000
Test critical values:	1% level		-3.470427	
	5% level		-2.879045	
	10% level		-2.576182	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(TD,2)				
Method: Least Squares				
Date: 07/21/20 Time: 17:15				
Sample (adjusted): 6 169				
Included observations: 164 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TD(-1))	-1.511702	0.139946	-10.80203	0.0000
D(TD(-1),2)	0.508803	0.120392	4.226222	0.0000
D(TD(-2),2)	0.496246	0.098169	5.055011	0.0000
D(TD(-3),2)	0.476685	0.069715	6.837642	0.0000
C	0.020686	5.143962	0.004021	0.9968
R-squared	0.610597	Mean dependent var		0.004896
Adjusted R-squared	0.600801	S.D. dependent var		104.2617
S.E. of regression	65.87485	Akaike info criterion		11.24340
Sum squared resid	689979.9	Schwarz criterion		11.33791
Log likelihood	-916.9591	Hannan-Quinn criter.		11.28177
F-statistic	62.32934	Durbin-Watson stat		2.003710
Prob(F-statistic)	0.000000			

LOANS AND ADVANCES

Null Hypothesis: D(LA) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=13)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-11.60747	0.0000
Test critical values:	1% level		-3.469691	
	5% level		-2.878723	
	10% level		-2.576010	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LA,2)				
Method: Least Squares				
Date: 07/21/20 Time: 17:16				
Sample (adjusted): 3 169				
Included observations: 167 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LA(-1))	-0.898902	0.077442	-11.60747	0.0000
C	-0.000141	0.035078	-0.004013	0.9968
R-squared	0.449511	Mean dependent var		-0.000285
Adjusted R-squared	0.446174	S.D. dependent var		0.609122
S.E. of regression	0.453306	Akaike info criterion		1.267403
Sum squared resid	33.90517	Schwarz criterion		1.304744
Log likelihood	-103.8281	Hannan-Quinn criter.		1.282559
F-statistic	134.7333	Durbin-Watson stat		1.989780
Prob(F-statistic)	0.000000			