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2017

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Abstract
In the last 37 years Nigeria has undergone several stages of financial reforms with different impacts on the economy. Hence, this paper empirically analyses the impact of financial reforms on credit growth in Nigeria using annual data from 1980 to 2016. The research work hinges on the theoretical underpinning of the McKinnon-Shaw hypothesis on the relevance of financial reforms in a lagging economy. Analysing the data with autoregressive distributed lag (ARDL) error correction representation and bounds testing techniques, we notably find evidence to this hypothesis and state that at higher real interest rate there is increased financial intermediation evidenced by credit growth. Other findings are that in the long-run, financial system deposits, inflation rate and per capita GDP are strong asymmetrical predictors of credit growth and real interest rate (the financial reform indicator) while the short-run relationships are indicator-specific. We further show that a long-run cointegration relationship exists between domestic credit and other covariates and likewise between the real interest rate and its regressors.

Keywords: autoregressive distributed lag; bounds testing, cointegration, credit growth, financial reform, interest rate
JEL Codes: E43; E44; G18; G21

1 Introduction

Financial reform is simply the process of moving towards market-determined rate of interest as well as market-determined prices as opposed to government-regulated rate of interest (known as interest rate ceiling). McKinnon (1973) and Shaw (1973) expounded the dangers of a repressive financial system on the economies of developing countries and conclude that repression is inimical to economic growth. They consider financial liberalisation or deepening to be the backbone of economic reforms in lagging economies (Balassa 1990) and explain it to mean the creation of higher interest rates that equate the demand and supply for savings and opinionated that increased rates of interest will lead to increased saving, increased financial activities (i.e. financial intermediation) as well as improving the efficiency of using savings (i.e. generating credits). Both agree that capital flight will occur once the real rate of return falls below the equilibrium rate due to rising inflation rate. That is, domestic savers will have no incentive to increase the stock of funds available for domestic investment (shifting preference for the acquisition of real assets) which in turn affects economic growth.

Financial sector reforms in Nigeria can be said to begin substantially in 1986 during the launch of the Structural Adjustment Programme (SAP), a fallout from the International Monetary Fund (IMF) loan conditionality (Osabuohien 2008; Omankhanlen 2012; Osuagwu and Nwokoma 2017). The first was termed "exchange rate reforms" which led to the creation of the first-tier and second-tier (autonomous) foreign exchange markets. The second stage of the reforms classified as "interest rate and monetary policy reforms" commenced in 1987 till 1996 with the liberalisation of interest rate, and the introduction of the auction market for government securities in 1989 as well as the continued use of cash reserve requirements, that is, direct monetary policy instruments (Edo 2012; Omankhanlen 2012; Orji, Aguegboh and Anthony-Orji 2015). The third stage was the banking and capital market reforms in 1987 with the deregulation of bank licensing, this policy led to the rapid increase of banks from 41 in 1986 to 120 by 1992. From 1988 to 2005, the banking system went through transitional processes with the reduction of the number of banks from 89 to 25 and the increasing of the minimum capital base from N2billion to N25billion (Egwakhe and Osabuohien 2009; Adelakun 2010; Shittu 2012). Lastly, in 2010 was a beehive of reforms from the abolishment of universal banking to the creation of the Asset Management Company (AMCON) tasked with buying out banks 'toxic assets', the comprehensive review of provisional guidelines for margin loans to mention a few. However, the reforms progress came not without hiccups (Olofin and Afangideh 2008; Omankhanlen 2012) at the initial stages but later led to improvements in financial indicators and economic growth. One of the favourable outcomes of the liberalisation process is the increase in bank credits to the private sector and also because economic growth and development hinges on the extent to which household and firms have access to credit[1].

Statistics from World Development Indicators of the World Bank (2017) indicate that the share of the banking system's credit to the private sector improved significantly from 34 per cent in

[1]Credit is measured as domestic credit to the private sector/GDP. This does not include loans and advances to the public sector.

the 1980s on the average to about 49 per cent in the 1990s and early part of 2000. The bulk of the credit to the private sector was mainly on short-term investment. The depth of the financial sector measured by the ratio of broad money supply to gross domestic products (M2/GDP), contrary to expectation, did not improve in the 1990s as a decline was recorded from 32.6 per cent on the average in the 1980s to 26 per cent. In 2006, the financial sector deepened with an increase in M2/GDP ratio from 16.4 per cent at the end of 2005 to 16.9 per cent in 2006. The banking system's capacity to finance economic activity was strengthened with a higher ratio of credit to the private sector to GDP than the preceding year. The ratio of credit to the private sector to GDP was 23.1 per cent at the end of 2006 (Bassey, Bessong and Effiong 2012).

Thus, this study contributes to literature by testing the McKinnon (1973) and Shaw (1973) hypotheses on Nigeria's financial reforms. Given that financial reforms embodies several components such as interest rate deregulation, removal of credit controls, removal of excessive reserve requirements, relaxation of entry, capital control deregulation and so on, studies have used a dummy variable or any of these indicators (where financial reform index is not available) to proxy financial reform. Thus, we use the real interest rate as the financial reform variable in examining the impact on credit growth (a measure of financial system stability). This study is important and policy-driven. One of the policy implications will be to guide financial regulators in understanding the extent to which the financial intermediaries, and economic agents (individuals, households and firms) respond to credit access given the direction of interest rate. The rest of this paper is organised as follows: section 2 reviews the literature, section 3 describes empirical methods, the results are presented and discussed in section 4 while section 5 concludes with policy implications.

2 Brief Insights from Extant Literature

Both the theoretical and empirical literature have been consumed with testing the McKinnon-Shaw (1973) hypothesis, to evaluate its reality and applicability. One of the salient points of their hypothesis is the impact of higher interest rate on both lenders and borrowers. According to them, savers and investors will operate in accordance with market dictates once the financial system shifts away from repression to reform. This is because interest rate ceiling creates a wedge between social and private returns, distorting intertemporal returns, which further shifts savings towards the acquisition of real assets (such as lands, gold), in addition to creating bias for current consumption.

There are contrary views on the effects of financial reforms. In this school of thought Wijnbergen (1982) and Taylor (1988) state that high interest rate may hamper financial deepening and hinder the economic growth of developing economies. They argue that a high interest rate has both positive and negative impact depending on who the financial dealer is. To the lender, such a rate is advantageous and will create the drive for more savings with the bid to earn more interest income while a high interest rate discourages access to loans thereby causing dis-investment in the real sector. Thus, the net effect of a high interest rate is excess liquidity within the financial system which creates a huge interest payment obligations on

financial intermediaries irrespective of their inability to create or generate corresponding credit. However, despite the arguments against financial reform, the populist opinion (also supported by the IMF and World Bank) is that the gains from financial reforms far outweighs that from a repressive financial system.

Empirical results on the impact of financial reform are varying given the usage of different proxy indicators in addition to different methodologies adopted. On Iraq, Khalaf (2011) finds that interest rate deregulation stimulates financial deepening encouraging savings and increasing financial assets in the long-run, but such may not be the case in the short-run. Chandar, Patro and Yezegel (2009) and Chung, Smith and Wu (2009) find that financial reform encourages savers and borrowers to operate in accordance with the dictates of market forces which would engender healthy competition and promote financial market efficiency. Orji, Aguegboh and Anthony-Orji (2015) find that financial liberalisation (proxied by domestic credit) promotes real sector activities.

On Nigeria, Akingunola et al. (2013) find that financial liberalisation proxied by the ratio of liquid liabilities, real interest rate, and total deposit does not significantly impact economic growth. Recent studies in Nigeria that used micro-level analyses include: Efobi, Osabuohien and Oluwatobi (2014) and Efobi, Beecroft and Osabuohien (2014). The former surmised the need for commercial banks to go beyond acting as agent for remittance collection to incorporating advisory roles for their customers, which will increase bank breadth. While the latter used World Bank Household Survey on financial inclusion to investigate the factors that can influence access to and use of bank services in Nigeria.

On the Ghanaian economy, Adam (2011) using a financial liberalisation index constructed using the Principal Component Analysis (PCA) finds positive and long-run relationship between financial liberalisation and economic growth. On South Africa, Odhiambo (2010a) finds strong support for the positive impact of interest rate reforms on financial development, and however financial development does not Granger cause investment and economic growth. Also, on the study of four Southern African Development Community (SADC) countries – Lesotho, South Africa, Tanzania, and Zambia, Odhiambo (2011) finds that although financial liberalisation leads to financial development in all the study countries, it Granger-causes economic growth only in Zambia and in the other countries, it is the economic growth which induces the development of the financial sector. On Pakistan, Hye and Wizarat (2013) find a positive relationship between the financial liberalisation index and economic growth in the short run and further concludes that the impact of real interest rate on economic growth is negative and significant in the long-run.

3 Empirical Model and Method of Analysis

3.1 The Empirical Model

A simplified theoretical framework of the McKinnon-Shaw (1973) hypothesis is that the creation of higher interest rate leads to increase in saving from depositors, increase in financial intermediation as well as improving the efficiency of using saving (i.e. generating credits). That

is, with high interest rates, sufficient funds are pooled from savers which allow banks channel such funds to the private sector in the form of credit. Hence, higher positive real interest rates are warranted to build up real money balances, increase financial intermediation and unification of financial markets, thereby ensuring an efficient utilisation of resources, particularly the scarce capital. The complementarity between money and capital accumulation will, therefore, continue to exist as long as the real positive interest rate does not exceed the real rate of return on investment (Odhiambo 2010b). Such that *credit* is a function of interest rate (the financial reform indicator) as stated in equation 1:

$$CR_t = f(INT_t) \quad [1]$$

where CR_t denotes credits and INT_t is the rate of interest.

An extensive time-series literature examines the finance-growth relationship using a variety of time-series methods. These studies frequently use Johansen test of cointegration, Granger-type causality tests and vector autoregressive (VAR) procedures to examine the relationships between macroeconomic variables and economic growth (Alege and Osabuohien 2013; Alege and Okodua 2014), or specifically the nature of the finance-growth relationship (Edo 2012). Overtime research has progressed by using better measures of financial development, employing more powerful econometric techniques, and by examining individual countries in much greater depth (Shan 2003; Shan and Jianhong 2006; Soultanaeva 2010).

Our research hypothesis is analysed within the autoregressive distributed lag (ARDL)[2] model framework. This approach has three advantages in comparison with other previous and traditional cointegration methods. First, the ARDL does not need all the variables under study to be integrated of the same order and can be applied when the underlying variables are integrated of order one, order zero or mixed. Secondly, the ARDL test is relatively more efficient in the case of small and finite sample data sizes. Lastly, by applying the ARDL technique the long-run unbiased estimates of the model are obtained (Harris and Sollis 2003; Belloumi 2014; Kripfganz and Schneider 2016). There are, therefore, important econometric advantages in examining the relationship between financial reforms and credit growth within the framework of an ARDL model. Thus, following Kripfganz and Schneider (2016), we modify the ARDL $(p, q, \dots, q)$ model as:

$$\boldsymbol{Y}_t = \varphi_{0i} + \sum_{i=1}^{p} \delta_i \boldsymbol{Y}_{t-i} + \sum_{i=0}^{q} \beta'_i \boldsymbol{X}_{t-i} + \boldsymbol{\varepsilon}_{it} \quad [2]$$

Where: $\boldsymbol{Y}_t$ represents either credit growth or real interest rate; and the variables in $(\boldsymbol{X'}_t)'$ are allowed to be purely $I(0)$ or $I(1)$ or co-integrated; $\boldsymbol{\varepsilon}_t = (\boldsymbol{\varepsilon}_{CRt}, \boldsymbol{\varepsilon}_{RRt})$; β and δ are coefficients; φ is the constant; p, q are optimal lag orders; $\boldsymbol{\varepsilon}_{it}$ is a vector of the error terms – unobservable zero mean white noise vector process (serially uncorrelated or independent).

[2]The optimal lag length for the model is 4. Using the Stata routine *"varsoc"*, it is obtained from the choice of Bayesian information criterion (BIC), Hannan–Quinn information criterion (HQIC) and Akaike information criterion (AIC) of which they all gave the same value, an indication that the model is well specified.

3.2 The Data and a priori Expectations

This study uses annual data on six (6) variables – domestic credit to the private sector/GDP, real interest rate, inflation rate, financial system deposits/GDP, GDP per capita growth and growth rate of gross fixed capital formation (investment). The data span is from 1980 to 2016 and all indicators are obtained from the World Development Indicators of the World Bank (2017) except financial system deposits sourced from World Bank (2016). Credit growth (*CR*) is proxied by domestic credit to private sector provided by financial institutions as a percentage of GDP. It measures the volume of credit facilities from the financial sector availed to households and firms excluding public sector credits. It is also a measure of financial depth and stability. The real interest rate (*RR*) is the lending rate adjusted for inflation as measured by the GDP deflator, it is the financial reform variable. The inflation rate (*INF*) as measured by the consumer price index reflects the annual percentage change in the average food basket of a consumer. Financial system deposits (*FSD*) a measure of financial depth reflects the volume of financial liquidity; the GDP per capita growth (*PCGr*) is the measure of economic growth while the growth rate of gross fixed capital formation (*INV*) captures the growth rate of gross domestic investment and real sector activities.

On the *a priori* expectations, with *CR* as the dependent variable, there is no consensus from empirical literature on the direction of the impact of *RR*. To some, high interest rate is inimical to growth (Fry 1980; Roubini and Sala-I-Martin 1992; De Gregorio and Guidotti 1995) while to some, it stimulates growth (International Monetary Fund 1983), hence, the relationship is ambiguous. *INF* is expected to have a positive relationship with *CR* and a negative relationship with *RR* as rising inflation causes the real rate of return to fall. *FSD* is expected to have a positive coefficient because with more loanable funds at the disposal of financial intermediaries, credit should increase and also with increased liquidities should drive down interest rates if loanable funds are not matched with credit creation, likewise the need for more funds may influence rates to rise. Increase in *PCGr* stimulates the need for more credit which may exert a positive effect on the real interest rate. *INV* is expected to have a positive effect on *CR* as the need for business expansion creates the demand for loans.

The theoretical justifications for the inclusion of the explanatory variables are summarised thus. The use of the interest rate as the financial reform variable stems from the Keynesian and neo-classical financial liberalisation theories (Molho 1986) to the theoretical and analytical frameworks of McKinnon (1973) and Shaw (1973). According to these schools of thought, deposit interest rate liberalisation allows savers to switch some of their savings from unproductive real assets to financial assets thereby leading to an increase in financial deepening, hence expanding the supply of credit in the economy, investment and economic growth. However, for this study, we use the real interest rate to ascertain the behaviour of domestic credit. Nigeria being an inflation-targeting economy justifies the inclusion of the variable in addition to being the second component of the real interest rate. On the inclusion of financial system deposits, the McKinnon-Shaw hypothesis posit that increase in the pool of funds from depositors' i.e. loanable funds encourages more financial intermediation (i.e. use of savings). Thus, increase in financial system deposits imply more loanable funds available for financial intermediation and hence more supply of credit. per capita GDP growth is included

to capture economic growth. This is because in the finance-growth literature there are two main hypotheses: the demand-following hypothesis (i.e. economic growth leads financial development) and the supply-leading hypothesis (finance leads growth). The former holds that as the economy develops, it creates the need for finance (need for credit) to accelerate growth (Robinson 1952; Patrick 1966; Chuah and Thai 2004) while the latter is of the view that financial system development drives economic growth. That is, under a supply-leading response, the development of financial institutions induces the development of the real sector of the economy (Spears 1992; King and Levine 1993; Odedokun 1996; Xu 2000). Hence, our inclusion of GDP per capita growth which is the proxy for economic size in the model. Lastly, gross fixed capital formation captures the real sector. Table 1 shows the summary statistics of each variable and their correlation matrix.

Table 1 Descriptive Statistics and Correlation Matrix

Variables	*Dom. Crdt.*	*Real Int.*	*Inf.*	*Fin. Sys.*	*PC Gr.*	*Inv.*
Mean	25.637	-0.200	19.343	17.372	0.900	2.975
Standard Deviation	11.695	16.371	17.515	5.485	7.316	23.264
Minimum	4.909	-43.573	5.382	8.480	-15.455	-35.997
Maximum	48.672	25.282	72.836	34.660	30.357	59.388
Domestic Credit	1.000					
Real Interest Rate	-0.096	1.000				
Inflation	0.238	-0.477	1.000			
Financial System Dep.	0.662	0.203	-0.221	1.000		
GDP per capita Growth	-0.488	0.361	-0.093	-0.200	1.000	
Investment Growth	-0.441	0.198	-0.218	-0.142	0.325	1.000

Source: Authors' calculations

The correlation matrix which reflects the observed associations among the variables, reveals that there is no exact linear dependence among them. However, the regression analysis will show their exact causal relationships.

4 Results and Discussion

4.1 Unit Root Tests

The empirical investigation of any analysis starts with the graphical illustration of the variables (Fig. 1) in order to visualise their time series properties as it is imperative that these variables be stationary in order to avoid obtaining spurious results. Graphical analysis reveals that the real interest rate looks stationary around its mean while domestic credit and financial system deposits exhibit unit roots.

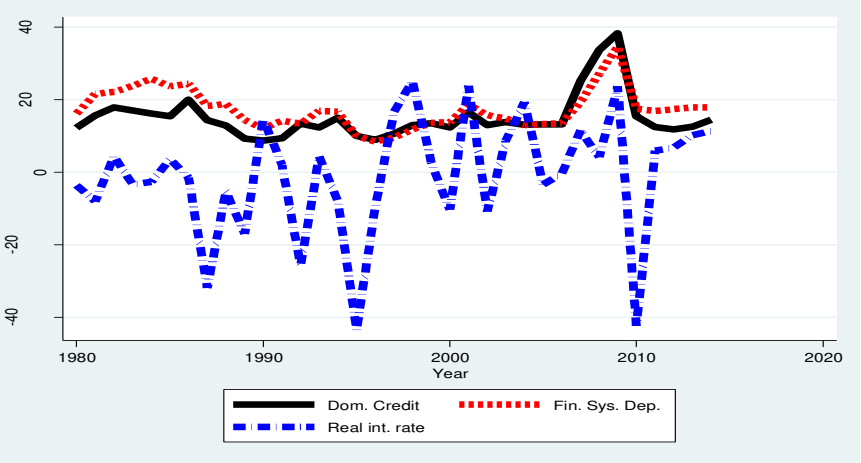

Figure 1: Trend of credit growth, real interest rate and financial systems deposits (1980 – 2016)
Source: Authors' computation from World Bank (2017) and World Bank (2016)

However, we subject all six variables to test using the Phillips-Perron (PP) test and the Dickey-Fuller generalised least squares[3] (DF-GLS) test. For these tests, the null hypothesis of a unit root cannot be rejected if the test statistic is insignificant. These results are shown in Table 2.

Table 2 DF-GLS (with trend) and PP Unit Root Tests

Variables	DF-GLS*			PP		
	Level	1st Diff.	Decision	Level	1st Diff.	Decision
Domestic Credit	-2.920	-3.735[b]	*I* (1)	-3.010	-5.470[a]	*I* (1)
Real Interest Rate	-6.581[a]	-	*I* (0)	-6.417[a]	-	*I* (0)
Inflation Rate	-3.046[c]	-	*I* (0)	-3.100	-5.486[a]	*I* (1)
Financial Sys. Dep.	-2.674	-4.096[a]	*I* (1)	-2.579	-5.728[a]	*I* (1)
GDP Per capita Gr.	-5.106[a]	-	*I* (0)	-5.180[a]	-	*I* (0)
Investment Growth	-2.251	-3.349[b]	*I* (1)	-5.235[a]	-	*I* (0)

Note: [a, b, c] denote statistical significance at 1%, 5% and 10% levels respectively. Estmations augmented with lag structures obtained from Bayesian Information Criterion (BIC) using the *varsoc* routine in Stata. *Interpolated critical values from Elliot, Rottenberg and Stock (1996).
Source: Authors' calculations

From the results shown in Table 2, our study sample is a mix of *I*(0) and *I*(1) series with both tests consistent with the results on domestic credit, real interest rate, financial system deposits and GDP per capita being *I*(1) while the results on inflation rate and investment growth are divergent.

4.2 Bounds Testing for Cointegration

Having established that the variables are integrated of different orders, we proceed to analyse if there exists any cointegration among the variables using the ARDL bounds test approach

[3]Proposed by Elliot, Rothenberg and Stock (1996), it is essentially an augmented Dickey–Fuller test except that the time series is transformed via a generalised least squares (GLS) regression before performing the test. Elliott, Rothenberg, and Stock and later studies have shown that this test has significantly greater power than the previous versions of the augmented Dickey–Fuller test.

(based on the error correction representation) as developed by Pesaran, Shin and Smith (2001). The bounds test is mainly based on the joint *F*-statistic whose asymptotic distribution is non-standard under the null hypothesis of no cointegration (i.e.$\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$) against the alternative hypothesis of a cointegrating relationship (i.e.$\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$). Under the bounds test, it is assumed that the model comprises both *I*(0) and *I*(1) variables and two levels of critical values are obtained. The first level is calculated on the assumption that all variables included in the ARDL model are integrated of order zero, while the second one is calculated on the assumption that the variables are integrated of order one. The procedure is to estimate the equation by ordinary least squares (OLS) and test for joint significance of the lagged levels of the variables. The null hypothesis of no cointegration is rejected if the *F*-statistic is higher than the critical value of both the *I*(0) and *I*(1) regressors, and not rejected if otherwise (Belloumi 2014). The use of this test is guided by the short data span (37 observations), we therefore use the critical values given in Narayan (2004, 2005). The results are shown in Table 3.

Table 3 Bounds Testing Results

Cointegration hypotheses	*F* -statistics
F_{CR}(Dom. Cr(log)$_t$|Real int.t rate$_t$|Inf. rate$_t$|Fin. Sys. dep.$_t$|GDPpcgr$_t$|Inv. Gr$_t$)	4.437[b]
F_{RR}(Real int. rate$_t$|Dom. Cr(log)$_t$|Inf. rate$_t$|Fin. Sys. dep$_t$|GDPpcgr$_t$|Inv. Gr$_t$)	26.595[a]

[a,b] represent significance at 1% and 5% respectively. The critical values for the *F* -statistics from Narayan, P. K. (2005) are 5.419 and 4.013 for 1% and 5% significance levels respectively.
Source: Authors' computations

The comparisons indicate that the null hypotheses of no cointegration is rejected at the 5% and 1% levels respectively as there are unique cointegrating relationships among the variables in the models and that the *long run forcing variables* are inflation rate, financial system deposits, growth rate of per capita GDP and investment growth in both relationships. For instance, when the real interest rate is the dependent variable, the calculated F_{RR}(Realint.rate$_t$|Dom.credit$_t$|Inf.rate$_t$|Fin.systemdep$_t$|GDPpcgr$_t$|Invgr$_t$) = 26.595 which is higher than the upper bound critical value of 5.419 at the 1% level. This indicates that there is a cointegrating relationship among the variables and the null hypothesis of no cointegration is rejected. Likewise another cointegrating relationship exists at the 5% significance level when domestic credit is the dependent variable. These results indicate that in both relationships, inflation rate, financial system deposits, growth rate of per capita GDP and investment growth are the forcing variables that move first when a common stochastic shock hits the system. The implication of the above finding is that: domestic credit and real interest rate follow changes in these indicators.

4.3 ARDL and ECM Results

Having established cointegration, we proceed to analyse the long-run relationships and short-run dynamics using a log-level autoregressive distributed lag (ARDL) error correction representation approach, and specify same as:

$$\Delta lnCR_t = \alpha_0 - \gamma(lnCR_{t-1} - \theta \boldsymbol{X}_t) + \sum_{i=1}^{p-1} \omega_{lnCRi} \Delta lnCR_{t-1} + \sum_{i=0}^{q-1} \omega_{Xi} \Delta \boldsymbol{X}_{t-i} + \boldsymbol{\varepsilon}_{1t} \quad [3]$$

$$\Delta RR_t = \alpha_0 - \gamma(RR_{t-1} - \theta \boldsymbol{X}_t) + \sum_{i=1}^{p-1} \omega_{RRi} \Delta RR_{t-1} + \sum_{i=0}^{q-1} \omega_{Xi} \Delta \boldsymbol{X}_{t-i} + \boldsymbol{\varepsilon}_{2t} \quad [4]$$

where Δ is the difference operator; $\gamma = 1 - \sum_{j=1}^{p} \delta_i$ is the speed of adjustment coefficient; $\theta = \frac{\sum_{j=0}^{q} \beta_j}{\alpha}$ is the long-run coefficient.

Equations [3] and [4] state that $\Delta lnCR$ (ΔRR) depends on its lag, the differenced explanatory variables and also on the equilibrium error term. If the latter is nonzero, then the model is out of equilibrium. Since γ is expected to be negative, its absolute value decides how quickly equilibrium is restored. The results are presented in Table 4 (log of domestic credit as the dependent variable) and Table 5 (real interest rate as the dependent variable).

Table 4 Error Correction Results (Dep. variable: ΔDomestic Credit, log) ARDL (*1 0 0 1 0 3*)

Constant	0.467 (1.23)	Constant	-4.019 (-0.30)
	Long-run estimates:		
Real Interest Rate	0.035[c] (2.06)	Dom. Credit, log	8.915 (1.48)
Inflation Rate	0.026[a] (2.94)	Inflation Rate	-0.452[a] (-4.24)
Financial Sys. Dep.	0.093[a] (3.75)	Financial Sys. Dep.	-0.914[c] (-1.86)
GDP per capita Gr.	-0.074[b] (-2.29)	GDP per capita Gr.	1.226[a] (4.07)
Investment Growth	0.010 (0.76)	Investment Growth	-0.201 (-1.26)
	Adjustment:		
Dom. Credit, log_1	-0.457[b] (-2.84)	Real Int Rate_1	-1.043[a] (-10.24)
	Short-run estimates:		
ΔFinancial Sys. Dep.	-0.028 (-1.19)	ΔDom. Credit, log	8.060 (1.22)
ΔInvestment Growth	0.0003 (0.09)	ΔFinancial Sys. Dep.	2.652[a] (5.08)
ΔInvestment Gr._1	0.004 (1.54)	ΔInvestment Growth	0.056 (0.42)
ΔInvestment Gr._2	0.007[a] (2.99)	ΔInvestment Gr._1	-0.006 (-0.06)
		ΔInvestment Gr._2	-0.151 (-1.70)
No. of Obs.	30	No. of Obs.	30
R-Squared	0.809	R-Squared	0.939

Note: Numbers in parentheses are *t*-statistics based on White heteroscedasticity-consistent standard errors. Statistical significance: [a,b,c] indicate 1%, 5% and 10% levels respectively. The variables lag length (*1 0 0 1 0 3*) for domestic credit model and (*1 1 0 1 0 3*) for real interest rate model are Stata-generated using the "*varsoc*" routine. Δ is the difference operator.
Source: Authors' computations

In Table 4, the error correction term (denoted *Adjustment*, the first lag of domestic credit) is found to be negative and statistically significant (-0.473). This term shows the speed of adjustment process to restore equilibrium following a shock in the long run equilibrium relationship. A negative and significant error correction term implies how quickly variables return to equilibrium. A relatively high adjustment coefficient (in absolute term) indicates a faster adjustment process. For instance, this result implies that almost 47 percent of the

disequilibrium of the previous year's shocks are corrected back to the long run equilibrium in the current year. Other results reveal that in the long run, credit growth is positively related to the inflation rate (0.0259), financial liquidity (0.0932) and negatively to per capita GDP (-0.0735). These variables are strong predictors of credit growth. Most importantly for our purposes, we find that credit growth is positively and significantly linked to the measure of financial reform in the long run. This effect is also economically significant as the point estimate implies that a 1 percent increase in the real interest rate leads to a rise of 0.03 percent in domestic credit, *ceteris paribus*. This evidences the positive impact of financial reform and further validates the McKinnon-Shaw (1973) hypothesis that higher interest rate causes increased financial intermediation evidenced by credit growth. It is reassuring that we are able to reproduce same with our approach. From the short-run coefficients, credit growth is strongly predicted by the second lag of investment growth (0.007). Lastly, the R^2 indicates that 81% variations in domestic credit are explained by the regressors.

The results shown in Table 5 are significantly different from those in Table 4 both in significance and magnitude. The adjustment term is larger (-1.0432) suggesting that the rate of adjustment to long-run equilibrium is faster and that the real interest rate adjusts to its realisation with a lag correcting 104 percent of the discrepancy between the long-term and short-term real interest rate within the period. This coefficient is slightly below -1 but falls within the dynamically stable range (Pesaran, Shin and Smith 1999; Loayza and Ranciere 2006) since it is not lower than -2 (that is, within the unit circle). This indicates that the feedbacks from financial reform is very effective in Nigeria and convergence to long-run equilibrium after a shock to the explanatory variables is instantaneous for the real interest rate (Narayan 2005). It also implies that the adjustment term produces dampened fluctuations around the equilibrium path of the real interest rate but convergence to long-run stable state is very rapid (Narayan and Smyth 2005).

For the long-run coefficients, the inflation rate (-0.4517), financial liquidity (-0.9136) and GDP per capita growth rate (1.2256) are strong predictors of interest rate with only the short-run coefficient on financial liquidity positive. Another important finding evidencing the McKinnon-Shaw (1973) hypothesis is that at higher inflation rate, the real rate of return falls. Again, the R^2 shows that 94% variations in the real interest rate are explained by the regressors. Overall, these results lend support to previous studies such as: Loayza and Ranciere (2006); Obamuyi and Olorunfemi (2011), Okoye and Eze (2013), Odhiambo (2010b, 2010a, 2011); Chipote, Mgxekwa and Godza (2014), Cubillasa and González (2014), and Orji, Aguegboh and Anthony-Orji (2015) that financial reforms have positive influence on credit growth.

4.4 Diagnostic Tests Results

The last issue we address is related to the goodness of fit of the ARDL-error correction models. For this purpose, series of diagnostic and stability tests were carried out. The diagnostic tests examine serial correlation, heteroscedasticity, conditional heteroscedasticity, Ramsey's

RESET[4] test and normality. The results reported in Table 6 indicate that there are no challenges of misspecification, heteroscedasticity, higher-order autocorrelation or normality in the model. This implies that the results from our analyses are robust and reliable for making inferences. Also, the plot of the CUSUMSQ shows that the model is stable as the graph lies within the 5% significance level boundaries (see Figure 2).

Table 6 Diagnostic Tests Results*

Specification	Stat./*p* -values	Conclusion
Durbin-Watson (autocorrelation)	2.122/1.899	No autocorrelation
Bruesch-Godfrey (autocorrelation)	0.442/0.975	No higher-order autocorrelation
Bruesch-Pagan (heteroscedasticity)	0.299/0.296	No heteroscedasticity
ARCH LM	0.779/0.686	No conditional heteroscedasticity
Ramsey RESET (omitted variables)	0.061/0.388	No omitted variables
Jarque-Bera (normality)	0.864/0.973	Evidence of normality

*The *p* -values *x/y* indicates results of when log of domestic credit/real interest rate is the dependent variable. The *d* -statistics used for Durbin-Watson.
Source: Authors' computations

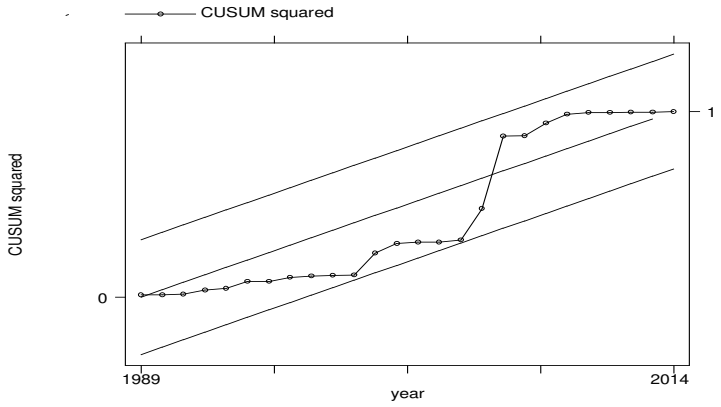

Fig. 2: Plot of CUSUMSQ for Model Stability at 5% level of Significance
Source: Authors' computation

5 Conclusion and Policy Implications

The nexus between financial reform and economic growth have received some measure of attention in extant studies. However, there is dearth of knowledge how such mechanism operates with respect to the channel of influence. Prodded with the above, this study extends the frontiers of knowledge in this area by examining the impact of financial reforms on credit growth in Nigeria. This objective was achieved by employing the autoregressive distributed lag (ARDL)-Bounds testing technique in analysing time series data spanning a period of 37 years (1980-2016). The empirical analysis is based on the assumption that the efficiency of the use of savings is directly related to a high and positive interest rate. We find evidences to the

[4]The null hypothesis of no omitted variables *cannot* be rejected at the 5% level with domestic credit as the dependent variable.

McKinnon-Shaw (1973) hypothesis that (1) at higher interest rate, financial intermediation improves as evidenced by credit growth, and (2) at higher inflation rate, the real rate of return falls. In addition, the inflation rate, financial system deposits and per capita GDP are strong predictors of both domestic credit and the real interest in the long-run, though asymmetrically. The short-run effects on these variables are also indicator-specific with investment growth having a significant positive impact on domestic credit while the real interest rate is positively related to financial liquidity. Given these results, we conclude that policies that will further increase credit be pursued by the government in order to revamp activities in the real sector and improve the efficiency of financial intermediation. Subject to data availability, the need to test the extent of financial intermediation, that is, the responsiveness of domestic credit to other variants of interest rate viz lending and deposit rates is important. This can be taken up in subsequent research.

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