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Does Interest Rate Spread Volatility Precipitate Investment in Nigeria?

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ABSTRACT
The work sought to investigate the impact of interest rate spread volatility on investment from 1986 to 2014. The investigation was anchored on a theoretical linkage of the Mckinnon -Shaw financial repression theory and the Ho and Saunders dealership theory. The Auto Regressive Conditional Heteroscedasticity Methodology was adopted for this study. The findings suggest that there is high volatility clustering with its persistence attributed to unconditional variance. The study also found out that interest rate spread volatility, does significantly impact on investment in Nigeria. This means activities surrounding the mobilization of savings from depositors and onward lending to investors, should be given due diligence in an effort to minimize interest rate spread which causes uncertainty that impacts negatively on investment and economic growth.
Keywords: Interest rate Spread Volatility, Interest rate Spread, Investment, Economic Growth, Auto Regressive Conditional Heteroscedasticity

INTRODUCTION
Financial intermediation by banks has been at the fulcrum of economic and policy discourse since it is viewed by most authors such as Ho and Saunders (1981), Chirwal (2001), Fawowe (2008), Folawewo and Tennat (2008), Kiptui (2014) as an indicator of banking sector efficiency. In their opinion, it has a concomitant positive effect on investment and economic growth. Financial intermediation by banks acknowledges that savings is mobilized from depositors for onward lending to investors. Interest rate being the price tag for both deposits and loanable funds solicits that banks do provide the right price to serve as a signal for saving-

investment transaction to operationalize. The differential or margin that exists between the price tag on savings and that of investment is termed interest rate spread (IRS). Jayaraman and Sharma(2005) views IRS as the difference between average interest rate earned on interest earning assets(loans) and average interest rate paid on deposits.

Advocates against financial repression such as Fawowe (2008), Chirwa (2001) had argued that the liberalization of the economy will unveil a competitive and market –based environment that will react on interest rate spread in developing economies to converge at international level. They further contend that the constrained growth process in developing economies has necessitated the need to adopt financial liberalization policies which would deepen the financial sector to pave way for competitive deposit and lending rates. This in turn would promote economic efficiency via the intermediary actions by banks. This means that smaller spreads indicate banking sector efficiency, which is attributed to liberalization and financial sector reform successes.

Despite the evolving argument for financial liberalization, there has been continuous swing or volatility in the behaivour of interest rate spread especially (its upward spikes) in transition or developing economies, which according to Kiptui (2014), Dabla-norris and Floerkeheler (2007) reveal high interest rate spread. This discourages potential savers with low return on deposits and increase the financing cost for borrowers thus reducing investment and growth opportunities.

In this connection, it has become necessary to further a discourse into the subject matter for a better understanding, while also noting that most works of this nature as expressed in the empirics, have investigated the effect interest rate spread directly on economic growth in other economic climes. This work, which is an impact analysis, attempts to fill the gap of investigating not only the extent interest rate spread volatility has on investment in Nigeria, but also the casual analysis

between them. This analysis will take its offshoot from 1986, as an ushering point, where prominence was ascribed to liberalization policy as a major developmental tool, for the Nigerian economy under the auspices of Structural Adjustment Program (SAP).

THEORITICAL REVIEW

This work fuses the McKinnon-Shaw (1973) theory of financial repression, which advocates for liberalization of the financial space so as to allow for competitive pricing of interest rates and the dealership model of Ho and Sanders(1981) which stipulates that a bank acts as an intermediary between the borrower(firms) and the lender(households) and as such faces the uncertainty risk of non- harmonization of loans and deposits resulting to an interest rate risk; and the default or credit risks which is a resultant of nonperforming loans. The bank's effort to set a buffer zone against insolvency will determine the level of interest rate spread. In essence the McKinnon-Shaw theory will spurt up a market- based environment that will elicit the right financial space for the dealership model to become operationalize. The market dynamics which also elicits the uncertainty risks will cause swings in the interest rate spread otherwise its volatility. The wider the spread, the expectation is for a higher banking sector inefficiency, which leads to lower investment. That is interest rate volatility has a negative relationship with investment.

EMPIRICAL REVIEW

Empirical Studies abound on the determinants of interest rate spread with most of them adopting the VAR and in some instances the OLS methodology for analysis. Studies such as Demirguc-Hunt and Huizina (1999) for a group of developing countries, Ngugi (2001) for Kenya, ADB (2001) for Sub Saharan Africa, Chirwa and Mlachila (2002) for Malawi, Chand (2002) for Kenya, Hossain (2010) for Bangladesh, Perez (2011) for Belize, Samahiya and Kaakirma (2013) for Namibia have attributed the causes of high interest rate spread to lack of competition, scale

diseconomies due to small size of markets, high fixed and operating costs, high transportation cost of funds, expensive telecommunications, existence of regulatory controls and perceived market risks. Jayaram and Sharma(2005) adduced reasons to IRS to two sources which they firstly tagged, factors widening IRS to include administrative cost, loan loss provisioning, tax payments, after profit margin, required reserves; secondly, factors decreasing spread to include remuneration on reserve, fees, charges levied on loans, income from foreign exchange .

Furtherance to the above, Folawewo and Tennant(2008) while citing several scholars aggregated the determinants of interest rate spread under three main categories to include firstly, bank specific factors (which are attributed to Non performing loans, overhead costs, excess liquidity and market share) secondly, market or industry specific factors to include(greater market power of commercial banks, poorly developed banking sector, high reserve requirement, inefficiency of the legal system and high corruption) thirdly, macroeconomic factors to include(high and variable inflation and interest rates, interest rate uncertainty proxied by inter-bank interest rate volatility, broad money growth, high share of commercial bank public sector loans).

Table 1 summarizes the methods and principal findings of several recent studies of the ability of the term spread to forecast output growth. Much of the research during the past decade focuses on the stability of the forecasting relationship over time. The studies find that the spread has been less useful for forecasting output growth since the mid-1980s, at least for the United States

Study	Methodology	Data(years)	Principal finding(s)	Notes
Galbraith and Tkacz (2000)	Single equation linear regression and smooth transition nonlinear asymmetric threshold model	G-7 developed countries quarterly (1960s – late 1990s; varies by country)	Spread predicts changes in output. Evidence for U.S and Canada of asymmetric nonlinear behaivour, where the impact of the spread is greater on one side of a threshold than on the other	Across a variety of specifications, the spread has its most significant predictive power when it is negative.
Berk and Van Bergeijk (2001)	Single equation linear models	Twelve developed countries and the euro area quarterly (1970- 98)	Term spread has little information about future output growth beyond that contained in lagged output growth for most countries. The U.S is an exception	Evidence of parameter instability for the U.S in the latter part of the sample but not for other countries or the euro area.
Tkacz (2001)	Neutral Networks	Canada, quarterly (1963-99)	Four-quarter forecasts of output growth outperform 1-quarter forecasts.	Neutral networks models outperform linear models at a 4-quarter horizon but not at a 1-quarter horizon.
Estrella, Rodrigues and Schich (2003)	Single- equation linear models	U.S and Germany, monthly industrial production (1955-98 for U.S, 1967-98 for Germany)	Spread forecasts, output growth well at 1-year horizons in both countries but less accurately at 2 and 3 year horizons.	Results are robust across several maturity combinations for the spread. Little evidence of instability for Germany but a break in 1983 for U.S at a 1-year horizon.

Hamilton and Kim (2002)	Linear Regression and GARCH models	U.S Quarterly(1953-98)	Cyclical behaivour of interest rate volatility is an important determinant of the spread and the term premium and a useful predictor of future interest rates.	Cyclical movements in volatility are unable to account for the spread and the term premium in forecasting output growth.
Stock and Watson (2003)	Linear regression and combination forecasts	Canada, France, Germany, Italy, Japan, U.K and U.S. quarterly(1959-99)	Some asset prices have predictive content for output growth, but results vary across time and by country forecast based on individual indicators are unstable.	Simple combination forecast such as computing the median or trimmed mean of a panel of forecast, seem to circumvent issues of instability in that they yield smaller errors than the autoregressive benchmark model. Combination forecasts are stable even though the individual predictive relations are unstable.
Jardet (2004)	Single- equation linear model; VAR-VECM to identity sources of structural breaks	U.S monthly industrial production and employment(1957-2001)	Spread forecasts output growth well, especially at 1-year horizons. Structural breaks occurs in1984 with diminished forecasting strength thereafter	VAR estimates suggest that a structural break is due to a drop in the contributions of monetary policy and supply shocks to the covariance between the spread and output growth.
Duarte, Venetis, and Paya (2005)	Linear and nonlinear threshold models	Euro area and U.S quarterly (1970-2000)	Significant nonlinearity exists in the term yield spread- output growth relation with respect to time and past output growth. Nonlinear model	With linear models, the term spread is a useful indicator of future output growth for the euro area. Linear models show signs of instability. Spreads are successful in predicting output growth when output growth

			outperforms linear model in 1-year out- of- sample forecast	has slowed.
Nakaoto (2005)	Single-equation linear model	Japan, monthly industrial production(1985-2001)	Spread forecasts output at 1-to-24-month horizons in models that account for a structural break in July 1991	Usefulness of the spread is robust to inclusion of other variables. Expected future changes in the short-term rates appear to contribute useful information both before and after 1991 and the term premium is useful only after 1991.
Aretz and Peel (2000)	Single-equation linear model	U.S, Quarterly GDP/GNP (1981-2006)	Spread Forecasts output growth at various horizons and includes information beyond that in the survey of professional forecasters	Results are robust to the use of real time or vintage data. The spread contributes no information in models that assume forecasters have asymmetric loss functions.
Benati and Goodhart (2000)	Bayesian VARs with time varying parameters	U.S and U.K, quarterly (1875-2005), Euro area, quarterly (1970-2003); Australia, quarterly (1957-2005); Canada quarterly (1975-2005)	Spread has considerable marginal predictive content for the U.S. before World War 1 and in the 1980s, but little during the interwar period or before or after the 1980s	Similar parameter stability is found in forecasts for other countries and in models that also include inflation and a short term interest rate. Results fail to distinguish clearly between leading explanations for why the spread may be useful for predicting output growth.
NOTES: Unless otherwise noted, the dependent variable in each study is the growth rate of real GDP. GARCH- generalized autoregressive Conditional Heteroscedasticity; GNP, gross national product; VAR, Vector Auto regression; VAR-VECM, VAR- Vector correction model				

Source: Culled from Wheelock and Wohar (2009)

MATERIALS AND METHODS

Data collection is made from various issues of Central Bank of Nigeria Statistical Bulletin for the variables in use for this work. The data covering a period of 1986-2014 are collected for the variables of interest to include interest rate spread (INTRS) and investment (INV). Thereafter, these variables undergo log transformation, which assist in reducing the complexity in dealing with large numbers as well as solve the problem associated with heteroscedascity. This will enable easier interpretation of the parameter estimates in their elasticities Gujarati (2003). The interest Rate Spread Volatility (INTRSV) is calculated by taking the percentage change of interest rate spread given the period studied.

Engel (1982) and Bellertov (1986) structured The Auto Regressive Conditional Heteroscedascity (ARCH) model which facilitates the testing of volatility clustering. The ARCH approach will be adopted for this work. Further determination of the causal links amongst the variables of interest would be investigated via Granger Pairwise causality test. Test to ascertain the existence of unit root would also be carried out using the Dickey-Fuller unit root test i.e. to test for stationarity of the series to avoid spurious results as expressed by Hacker and Hatemi (2004) that in the presence of unit roots, the Standard distribution of test statistics are not correct and there is a risk of having spurious regression results. Thereafter, the cointegration test would be applied to ascertain the existence of long-run relationship amongst the variables studied. The Akaike Information Criteria (AIC) and Schwartz Information Criteria (SIC) aside showing the goodness of the model would also be used to ascertain the maximum distribution of the lag length.

Model Specification

Volatility test on financial series that tend to exhibit wide swings and relative calm over certain periods takes the generalized format of the ARCH model represented as follows:

$$\Delta Y_t = \alpha_o + \sum_{i=1}^{Q} \alpha_{1i}\Delta LNX_1 + \sum_{i=1}^{Q} \alpha_{2i}\Delta LNX_2 \ldots + \sum_{i=n}^{Q} \alpha_{ni}\Delta LNX_{n} + \varnothing_i\sqrt{h} + \varepsilon_t \quad (1)$$

$$\varepsilon_t/\Omega_{t-1} \sim N(0, h^2_t) \quad (2)$$

$$h^2_t = \alpha_o + \lambda_t \varepsilon^2_{t-1} + \varnothing_i h^2_{t-1} \quad (3)$$

In this case Q stands for the lag length for the ARCH model while ΔX_t and ΔY_t are the first differences of the logarithms of the dependent and independent variables respectively. α_o are the intercepts of the regressions. α_1 to α_n are the coefficients of the variables. ε_t- equates the error term. h^2_t is the conditional variance. Ω_{t-1} represents all information available in the previous year. λ_t and $\varnothing_i$ are the ARCH and GARCH coefficients respectively, whose coefficients measures the short run dynamics of the volatility of the data.

A large value of λ_t reflects a strong volatility clustering, while a large value of $\varnothing_i$ shows that the impact of the shock to the conditional variance last for awhile before dying out or volatility is persistent. If $\lambda_t + \varnothing_i <$ or $>$ and $= 1$ then GARCH(q,p) model is covariance stationary, non stationary and the volatility will explode to infinity respectively. Alexander (2007)

It is worthy to note as observed by Alshogeathri (2011), He and Terasvirta (1999) that in the GARCH model, the sign of the shock is irrelevant, which contrast the non-negative conditions of Engle (1982) and Bollerslev (1986) assumed to be too restrictive. That good news corresponds to negative shocks ($\varepsilon^2_{t-1} < 0$) since it leads to fall in conditional volatility, while bad news corresponds to positive shocks ($\varepsilon^2_{t-1} > 0$) since it brings about increase in conditional volatility.

Apriori Expectation

The a priori expectation is that Interest Rate Spread volatility has a negative relationship with investment and subsequently economic growth.

Data Presentation and Analysis

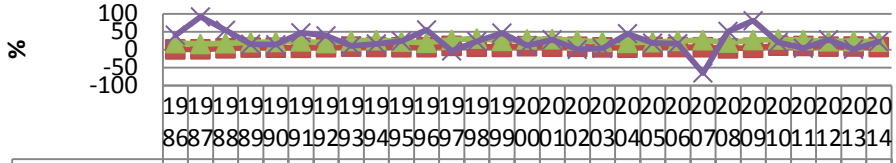
Table 2: Data Showing some Variables of Interest Selected for the Study

	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Jarque-Bera	Prob	Obs.
INTRSV	2.12	-2.78	75.68	-91.43	30.97	-0.3	4.84	4.52	0.1	29
INTRS	6.81	7.2	11.1	0.7	2.48	-0.71	3.58	2.82	0.25	29
INV	16.48	16.2	22.8	11.7	2.62	0.58	3.08	1.65	0.44	29

Source: Author's computation

Data presented for the 29 observations on table 1 shows the mean, median, maximum, minimum and Standard Deviation of the variables of interest selected for this work. Table 2 has further revealed the Jarque-Bera (JB) statistics, which is the test for the normality of the selected variables. This test has revealed the absence of normality due to the high probability values of all the variables at above 5% level of significance. The JB statistic which is also the result of the joint hypothesis using the Skewness (S) and Kurtosis(K) assumes that for it to happen then S=0 and K=3. From the results shown in table 2 it clearly validates the position of non-normality of the variables as such necessitating the need for further tests. Since the value of S< 0 then it is slim- tailed and skewed to the left for the negative values but skewed to the right for the positive values. On the other hand since K>0 for all the variables then it is peaky at the top or leptokurtic. The trend of the variables from 1986 to 2014 is captured on fig 1 below.

Fig 1: Trend of Rates of the Variables of Interest in the Study.



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
INTRSV	2	7	3	-	-	2	2	-	-	1	3	-	-	2	-	-	-	-	2	-	-	-	3	5	-	-	4	-	0
INV	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	2	1	2	1	1	1	1	1
INTRS	1	1	4	6	6	5	7	8	7	7	7	1	8	8	1	8	8	7	6	7	7	7	4	5	1	1	8	9	7

A cursory look at the trend has shown Interest Rate Spread (INTRS) averaged about 6.81% overtime while peaking at 11.7% in 2010 and recording an all time low in 1986 of 0.7%. Correspondingly, investment which is taken in this work as a percentage of Gross Domestic Product has averaged at about 16.5% with the highest investment recorded in 1998 of about 23% and the lowest been about 12% in 1992. By observation, interest rate spread in 1986 had send the right signal in causing investment to move in the right direction since a 0.7% noticed as interest rate spread caused investment to take an upswing of 17% of GDP which is above its average of 16.5% overtime. The case is different by 2010 when interest rate spread had attained its highest value of 11.7%. The expectation in 2010 due to the increased interest rate spread from 0.7% in 1986 to 11.7% in 2010(indicative of banking sector inefficiency) is for investment to reduce drastically. This is not the case since investment has still maintained a 17% of the nation's GDP. This has further substantiated the case that there are other strong determinants of investment as adduced by several scholars such as Demirguc-Hunt and Huizina (1999) Chirwa and Mlachila(2002) Hossain(2010) Perez(2011) Samahiya and Kaakirma(2013) Jayaram and Sharma(2005).

The trend in Fig 1 also reveals the existence of volatility clustering of interest rate spread, as each new period yields new information that result to higher volatility expected to bring with it large returns. This

according to Kirchler and Huber (2007) is attributed to the phenomena of heterogeneity of expectations.

ADF Stationarity Test

The results of the unit root test using Augmented Dickey- Fuller Approach as shown on table 3 below reveal that all the variables exhibit stationarity at level and integrated at order 0.

Table 3: ADF Unit Root Test

Series	ADF Test Statistics	0.05 critical Value	Order of Integration
D(INTRS)	-6.872238	-2.976263	I(0)
D(INTRSV)	-22.80637	-2.976263	I(0)
D(INV)	-4.087212	-2.976263	I(0)

Source: Author's computation

Cointegration Test

The Johansen Cointegration test for the existence of long run relationship amongst the variables is justified due to the order of integration of the series used for this study. The results have shown that there exists a long-run relationship amongst the variables studied as shown on table 4 below.

Table 4: Johansen Cointegration Test for Long run Equilibrium

Hypothesized		Trace	0.05		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	Statistic	Critical Value	Prob.**
None *	0.995059	164.4547	29.79707	0.0001	143.3759	21.13162	0.0001
At most 1	0.384945	21.07882	15.49471	0.0065	13.12316	14.26460	0.0751
At most 2	0.255211	7.955660	3.841466	0.0048	7.955660	3.841466	0.0048

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level, while Max-Eigen Statistics indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's computation

Results in table 4 above show that the while the trace statistics indicates 3 cointegrating equations, the Max-Eigen values suggest the existence of one cointegrating equation, as such the decision to uphold the Max-eigenvalue as a superior statistics in an event conflicting cointegrating results arise. Johansen and Juselius (1990)

Pairwise Granger Causality Tests

The Pairwise Granger causality test at two- lagged for the period 1986-2014 revealed one unidirectional causation i.e. from Interest rate spread to interest rate spread volatility. These results are depicted on table 5 below.

Table 5 : Pairwise Granger Causality Tests
Date: 07/11/15 Time: 00:29
Sample: 1986 2014
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNINTRS does not Granger Cause LNINTRSV	27	3.64946*	0.0428
LNINTRSV does not Granger Cause LNINTRS		0.33741	0.7172
LNINV does not Granger Cause LNINTRSV	27	0.76353	0.4780
LNINTRSV does not Granger Cause LNINV		0.29255	0.7492
LNINV does not Granger Cause LNINTRS	27	0.63377	0.5400
LNINTRS does not Granger Cause LNINV		0.39458	0.6786

Note: that (*) is significant at 5% level
Source: Author's computation

Table 6 presents results of the model specified for the analysis with dependent variable been interest rate spread volatility while the

independent variables are interest rate spread and investment.

Table 6: Results of the specified model

ARCH-M Equation	Dep. Variable: LNINTRSV From 1986 to 2014	
Variable	Coefficient	Prob.
LNINTRS	45.20698	0.0000
LNINV	-37.80452	0.0000
C	14.83063	0.5487
Variance Equation		
RESID(-1)^2	1.335819	0.0324
GARCH(-1)	-0.061821	0.4696
C	24.76761	0.2836
R^2	0.51	
Durbin-Watson Stat	1.59	

Source: Author's computation

Table 6 does explain that the independent variables included in the model do explain about 51% of the variations noticed in interest rate spread volatility. The DW Statistic of 1.6 is within the acceptable range and do reveal minimal level of negative autocorrelation.

The mean return coefficients have shown a positive relationship between interest rate spread and its volatility. That is a 1% increase in interest rate spread will lead to a 45% increase in interest rate spread uncertainty. On the other hand, the relationship between investment and interest rate uncertainty is negative, which is in tandem with a priori expectation. This means that a 1% increase in investment will lead to a 37% decrease in interest rate uncertainty. The results also show that Interest rate spread and investment are determinants of interest rate spread uncertainty or volatility since they are statistically significant at 5% level.

The variance equation have shown statistical significance at 5% level for the ARCH coefficients while depicting statistical insignificance at 5% level for the GARCH coefficients. This explains that though there exist interest rate spread volatility clustering, its impact or persistence is attributable to past activities of interest rate spread (i.e. ARCH effect) than news coming from the previous interest rate volatility(i.e. GARCH effect). This further explained by the greater than one or high coefficient of ARCH been 1.34 and low coefficient of GARCH been -0. 06. In essence a shock in the system will lead to bad news since interest rate spread uncertainty will increase causing the unconditional variance to persist, even though volatility clustering due to previous information or conditional variance will fizzle out quite fast. This is further substantiated by the fact that the GARCH (1, 1) model is covariance non stationary (or persistence of volatility clustering) since the addition of the ARCH and GARCH coefficients is greater than one.

SUMMARY AND CONCLUSION

This work investigated the impact of interest rate spread volatility on investment from 1986 to 2014, while noting that the period selected was done after taking hindsight of the government's position to liberalize the economy via policies associated with structural adjustment program.

The results reveal that the covariance analysis disaggregated into conditional variance and unconditional variance is non stationary since the summation equates a result with a greater than one value. This also suggests that there is high volatility clustering with its persistence attributed to unconditional variance or the ARCH effect. Further analysis have revealed that interest rate spread volatility has an accompanying negative relationship with investment and a positive relationship with interest rate spread, which is in tandem with a priori expectation. In other words, interest rate spread volatility does significantly impact on investment in Nigeria, as such activities surrounding the mobilization of savings from depositors and onward

lending to investors, should be given due diligence in an effort to minimize interest rate spread which causes its uncertainty that has a negative impact on investment and economic growth. This has the capacity to improving the financial intermediary role of banks in Nigeria.

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