

Threshold Effects in the Relationship between Interest Rate and Financial Inclusion in Nigeria

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Abstract

This study uses a non-linear threshold model to shed light on the impact of interest rates on financial inclusion in Nigeria for the period 1981 to 2014. The findings suggest that the threshold level of interest rates in Nigeria is estimated at 16.9 percent. In other words, interest rate hampers financial inclusion if it exceeds 16.9%. Below this threshold, however, the impact of interest rate remains insignificant. Thus, the results of this study support financial inclusion-dampening effects of interest rates in Nigeria. The logical conclusion is that Nigeria, and other developing countries as well, with lending interest rates above 16.9 percent should aim to attain interest rate levels that do not deter financial inclusion by adopting policies that drive down interest rates.

Keywords: Interest Rate Thresholds; Interest Rate; Financial Inclusion; Threshold Model.

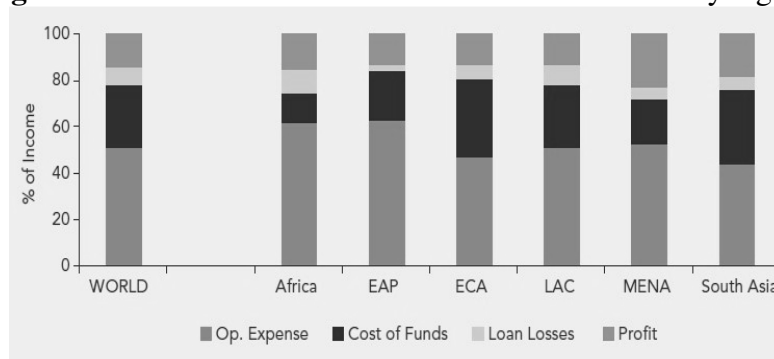
Introduction

Most economists would agree that interest rate can have distortional effects on financial inclusion if it gets too high. Yet how high is too high? There may be a trade-off between lowering interest rates and attaining sustainable and higher financial inclusion? At

operational level, the interest rate-financial inclusion nexus may depend on the level of interest because, at very low levels of interest rates, financial service providers may decline to provide credit, but higher levels of interest, as well, is likely to be inimical to financial inclusion. In this study, this relationship is translated into a threshold model, where when interest rates exceed the threshold, higher interest rates become immediately very harmful to financial inclusion.

With the wide-ranging spectrum of policies for financial sector liberalization, it is noteworthy that interest rate reform has occupied an important spot in the attainment of efficiency in the financial sector and in encouraging financial inclusion in economies all over the world (Evans, 2016; Evans and Saibu, 2017). However, interest rates have not been favorable, especially with regards to the poor. Rosenberg, Gonzalez and Narain (2009) evaluated whether the poor were being exploited by prohibitively high interest rates. They found some evidence of microfinance institutions spawning very tall profits from their clients. According to the study, the most profitable 10% of microfinance institutions globally were making returns in excess of 35% on equity (Figure no. 1).

Fig. no. 1. Cost structures of Microfinance Institutions by region



Source: Rosenberg et al (2009)

There are therefore several motivations for this study. This study was prompted by the recent increase in the official interest rate to 13% in Nigeria. Increasing the discount rate has increased lending interest rates and curtailed the lending capacity of the banks, with consequent deleterious impacts on financial inclusion. This act conflicts with the drive for financial inclusion in Nigeria. It is therefore necessary to ask

whether the interest rate level is appropriate and when, if possible, it can be detrimental.

Moreover, an exhaustive review of the interest rate literature on one hand and the financial inclusion on the other has shown that the issue of the estimation of the interest rate threshold for financial inclusion has received surprisingly little or no attention, conceptually, empirically and methodologically, except a little mention in Miller's (2013) *Interest Rate Caps and Their Impact on Financial Inclusion*. This study therefore fills the gap in the literature by providing evidence of a threshold level of interest rate above which the impact of interest rate is negative and statistically significant, using Bai and Perron's (2003) threshold estimation approach to estimate the number of threshold points, their values and their coefficients.

Literature review

Financial inclusion is generally defined in the literature to mean access of the working age population to financial services provided by formal financial institutions: credit, savings, payments, and insurance (Demirgüç-Kunt et al., 2014; Global Partnership for Financial Inclusion, 2016). Financial inclusion also means that “individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way” (The World Bank, 2017, p.1). Financial inclusion can also denote the provision of a broad spectrum of financial services (e.g. savings, loans, deposits, insurance) to the poor who usually do not have access to such services (Dev, 2006; Sarma, 2008; Demirgüç-Kunt and Klapper, 2013). Access to financial services (including other non-credit products) at household level enables rural households to meet consumption and social demands (i.e. food, health care, school fees, and funeral expenses), without having to divert financing from investment opportunities (Evans, 2015).

As there is a large and increasing number of studies dealing with financial inclusion (Dev, 2006; Thorat, 2006; Sarma, 2008; Demirgüç-Kunt and Klapper, 2013; Massara and Mialou, 2014; Adeola and Evans, 2017b; Evans and Adeoye, 2016; Evans and Saibu, 2017; Evans and Lawanson 2017; Fan and Zhang, 2017; Russell, Bowman, Banks and de Silva, 2017; Souza and Devaraja, 2017), so also is a vast amount of literature (e.g. McKinnon, 1973; Shaw, 1973; Athukorala, 1998; Soyibo and Olayiwola, 2000; Favero and Giavazzi, 2005; Karlan and Zinman,

2006; Shrestha and Chowdhry, 2007; Rosenberg, Gonzalez and Narain, 2009; Awan, Munir, Hussain and Sher, 2010; Obawuyi and Demehin, 2012) coming from multiple domains dealing with interest rate.

The debate on the relationship between interest rate and finance, however, has remained a perennial and hotly debated issue which has amassed sizeable theoretical and empirical literature (Loizos, 2017). According to the McKinnon-Shaw (1973) hypothesis, “a low or negative real rate of interest discourages savings and hence reduces the availability of loanable funds, inhibits investment, and ultimately lowers the rate of economic growth. On the contrary, an increase in the real interest rate may induce the savers to save more, which augments investment. This may lead to complementarities between the accumulation of financial assets and physical capital accumulation” (Awan et al., 2010, p. 79).

High interest rate on bank deposits encourages domestic savings and private investment (Athukorala, 1998). Deregulation of interest rates promotes savings, investment and efficient allocation of financial resources (Shrestha and Chowdhry, 2007). Awan et al. (2010) show that the real interest rate, financial liberalization and economic growth, in the long run, have positive impacts on domestic savings in Pakistan. Liberalization dummy is also significantly positive, signifying a need for better liberalization and deregulation of interest rates for higher mobilization of savings.

Only few existing studies assess interest rates with regards to the poor. Karlan and Zinman (2006), in a randomized survey in South Africa, examined the notion that the poor are non-sensitive to interest rates and found that, around the lender’s standard rates, demand elasticities rose sharply, signifying that even a marginal rise in interest rates could lead to a substantial drop in credit demand. In response to Karlan and Zinman’s (2006) findings, Miller (2013, p. 8) argued that “If the poor are indeed this responsive to changes in the interest rate, then it suggests that usurious lending practice would not be commercially sustainable and hence there is little need for government to cap interest rates”.

Notwithstanding the wide-ranging spectrum of policies for financial sector liberalization, interest rates have not been favorable with regards to the poor. For example, Rosenberg et al (2009) showed that the poor were being exploited by prohibitively high interest rates, as microfinance institutions are spawning very high profits from their poor

customers. The authors showed that the most profitable 10% of microfinance institutions were making returns in excess of 35% on equity.

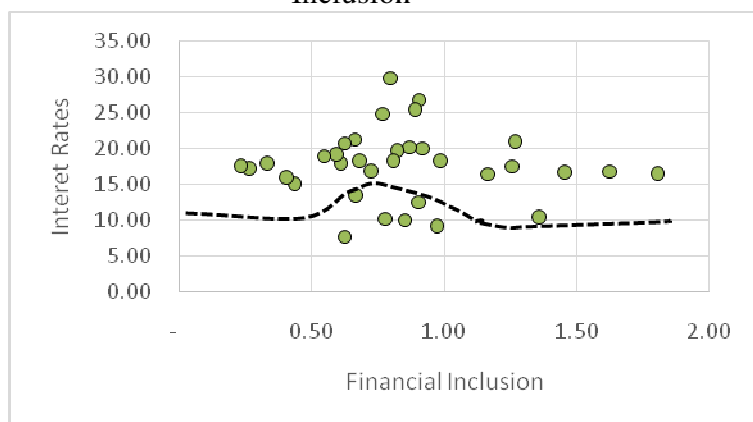
An exhaustive review of the literature has shown that the issue of the estimation of the interest rate threshold for financial inclusion has received surprisingly little or no attention, both in developed and developing countries. To the best knowledge of the author, no other study has examined the threshold effects of the relationship between interest rates and financial inclusion. This study therefore fills the gap in the literature by providing evidence of a threshold level of interest rate for financial inclusion, using Bai and Perron's (2003) threshold estimation approach to estimate the threshold points, their values and their coefficients.

Data and Methodology

The following empirical analysis employs annual data from 1981 to 2014 on Nigeria. While Real GDP per capita is obtained from the World Development Indicators, total commercial banks' loans and advances, gross domestic product (GDP), credit to the private sector, money supply and lending interest rate are collected from the Central Bank of Nigeria. Following the existing literature, financial inclusion is computed as outstanding loans from commercial banks (as % of GDP) (Mbutor and Uba, 2013; Adeola and Evans, 2017a; Evans, 2017). It is noteworthy that the current study used only outstanding loans of commercial banks (as % of GDP) as a measure of financial inclusion, in contrast with Mbutor and Uba (2013) and Adeola and Evans (2017a) which used other measures in addition. The reason is not far-fetched. While outstanding loans of commercial banks (as % of GDP) measures financial usage, the other measures used by those studies only measures financial access. It is well-known in the literature that what matters is financial usage, not just access.

A non-linear relationship between interest rates and financial inclusion appear to hold for the data on Nigeria as depicted in Figure 2. Interest rate has a significant negative impact on financial inclusion once it crosses the threshold level, while below the threshold level it is expected to have an insignificant impact.

Fig. no. 2. Non-linear Relationship between Interest Rates and Financial Inclusion



The threshold regression model is a form of non-linear regression containing piecewise linear specifications and regime switching which happens when a variable crosses unknown thresholds. Threshold models are able to produce remarkable nonlinearities and rich dynamics (e.g., Hansen, 2001; Bai and Perron, 2003; Perron, 2006).

Consider a standard multiple linear regression model with T observations and m potential thresholds (producing $m+1$ regimes).

For the observations in regime $j = 0, 1, \dots, m$ we have the linear regression specification

$$y_t = X_t' \beta + Z_t' \delta_j + \varepsilon_t \quad (1)$$

Where y is financial inclusion (FINC); X is a vector of covariates such as credit to the private sector (CREDIT), money supply (MONEY) and exchange rates (EXRATES); and Z is lending interest rates (INTEREST).

The regressors are in two groups. The X variables have parameters which do not vary while the Z variables are regime-specific.

Consider a threshold variable q_t and strictly increasing threshold values ($\gamma_1 < \gamma_2 < \dots < \gamma_m$) in such a way that we have regime j only if $\gamma_j \leq q_t < \gamma_{j+1}$. $\gamma_0 = -\infty$ and $\gamma_{m+1} = \infty$

Thus, we are in regime j if the threshold variable is less than or equal to the j -th threshold value, but less than the $(j+1)$ -th threshold.

For instance, in the single threshold, two regime model in the current study, we have:

$$\begin{aligned}
 y_t &= X_t' \beta + Z_t' \delta_1 + \varepsilon_t && \text{if } -\infty < q_t < \gamma_1 \\
 y_t &= X_t' \beta + Z_t' \delta_2 + \varepsilon_t && \text{if } \gamma_1 < q_t < \infty
 \end{aligned}
 \tag{2}$$

Then, employing an indicator function $k(\cdot)$ which takes the value 0 when the expression is false and 1 otherwise and equating $k_j(q_t, \gamma) = k(\gamma_j \leq q_t < \gamma_{j+1})$, the $m+1$ individual regime specifications can be combined into a single equation:

$$y_t = X_t' \beta + \sum_{j=0}^m k_j(q_t, \gamma) Z_t' \delta_j + \varepsilon_t
 \tag{3}$$

Non-linear least squares is the usual approach used to estimate the parameters of the model. By defining the objective function of the sum of squares as:

$$S(\delta, \beta, \gamma) = \sum_{t=1}^T \left(y_t - X_t' \beta + \sum_{j=0}^m 1_j(q_t, \gamma) Z_t' \delta_j \right)^2
 \tag{4}$$

We can obtain the threshold regression estimates by minimizing $S(\delta, \beta, \gamma)$ with respect to the parameters.

Empirical Results

Ascertaining the order of integration of the variables is indispensable in any econometric modeling. For that reason, we test for the order of integration of the variables, using the Kwiatkowski, Phillips, Schmidt and Shinz (KPSS, 1992). KPSS is more potent than common unit root tests such as Augmented Dickey Fuller and Phillips Perron tests which have the drawback of poor small-sample power often leading to wrong unit root conclusions. The KPSS test indicates that the variables FINC, INTEREST, MONEY, CREDIT and EXRATES are integrated of order one (Table no. 1).

Table no. 1. The KPSS Unit Root Test

Variable	Without trend		With trend	
	I(0)	I(1)	I(0)	I(1)
$FINC_t$	0.656	0.157*	0.167	0.123*
$INTEREST_t$	0.188	0.077*	0.149	0.062*
$CREDIT_t$	0.561	0.205*	0.187	0.202*
$MONEY_t$	0.597	0.129*	0.194	0.144**
$EXRATES_t$	0.628	0.131*	0.453	0.114*

Then we test for the presence of cointegrating relations among the variables. The Johansen (1991; 1995) cointegration test for the five series confirms that these variables are co-integrated, meaning a long-run relationship exists between them (Table no. 2).

Table no. 2. Johansen and Maximum Likelihood Test for Cointegration

Hypotheses	Trace Test	5 % Critical Value	Prob. #	Hypotheses	Max. Eigen Statistic	5 % Critical Value	Prob. #
$R = 0$	43.402	33.876	0.002	$R = 0$	69.818	0.001	89.324
$R \leq 1$	24.971	27.584	0.104	$R \leq 1$	47.856	0.075	45.922
$R \leq 2$	14.298	21.131	0.341	$R \leq 2$	29.797	0.360	20.950
$R \leq 3$	6.516	14.264	0.547	$R \leq 3$	15.494	0.618	6.6521
$R \leq 4$	0.135	3.841	0.713	$R \leq 4$	3.841	0.713	0.135

*Notes: * and ** denotes rejection of the hypothesis at the 0.01 and 0.05 level.*

denotes MacKinnon-Haug-Michelis (1999) p-values

The estimated interest rate threshold is 16.9 as shown in the lower part of Table 1. This threshold is significant at the 0.05 level,

based on Bai-Perron (2003) critical values. In other words, the interest rate threshold for financial inclusion in Nigeria is 16.9%.

Table no. 3. Threshold Specification

Sequential F-statistic determined thresholds: 1			
Threshold Test	F-statistic	Scaled F-statistic	Critical Value**
0 vs. 1 *	5.984399	23.93760	16.19
1 vs. 2	3.105380	12.42152	18.11
* Significant at the 0.05 level.			
** Bai-Perron (Econometric Journal, 2003) critical values.			
Threshold values:			
	Sequential	Repartition	
1	16.9375	16.9375	

Notes: Bai-Perron tests of L+1 vs. L sequentially determined thresholds, Threshold test options: Trimming 0.15, Max. Thresholds 5, Sig. level 0.05

The upper part of Table no. 2 shows the impact of interest rate on financial inclusion. Interest rate has significant negative impact on financial inclusion. The interest rate coefficient is significant and plausibly signed. -2.27 indicates that interest rate is harmful for financial inclusion when interest rates get too high. In other words, high interest rates can deter faster financial inclusion. The middle part shows the regime-dependent coefficients of interest rates on financial inclusion: when interest rate is below or above the estimated threshold value.

Table no. 4. Interest Rate thresholds and financial inclusion

Dependent Variable: FINC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Impact of interest rates				
INTEREST	-2.273943	0.707334	-3.214808	0.0036
Impact of Covariates				
INTEREST < 16.9375				
C	0.966185	0.073405	13.16247	0.0000
CREDIT	0.000329	0.000106	3.088065	0.0047
MONEY	-0.000152	0.000131	-1.162609	0.2555
EXRATES	-0.013887	0.004253	-3.265373	0.0031
INTEREST \geq 16.9375				
C	0.986657	0.072978	13.51996	0.0000
CREDIT	0.000120	0.000153	0.782107	0.4412
MONEY	-0.000139	0.000155	-0.891905	0.3806
EXRATES	-0.002157	0.001476	-1.461391	0.1559
R-squared	0.768296			
Adjusted R-squared	0.705914			
F-statistic	12.31600			
Prob (F-statistic)	0.000001			
Durbin-Watson stat	1.842717			

Notes: Threshold selection: Trimming 0.15, Sig. level 0.05, Threshold type: Bai-Perron tests of $L+1$ vs. L sequentially determined thresholds.

Finally, to establish the stability of the model, CUSUM and CUSUMSQ plots are drawn. Figure no. 3 shows the plot of cumulative sum of recursive residuals, while figure no. 4 depicts the plot of

cumulative sum of squares of recursive residuals. Both CUSUM and CUSUMSQ are within the critical bounds of 5 percent. Thus, it can be concluded that the model is structurally stable.

Fig.no. 3. CUSUM Test

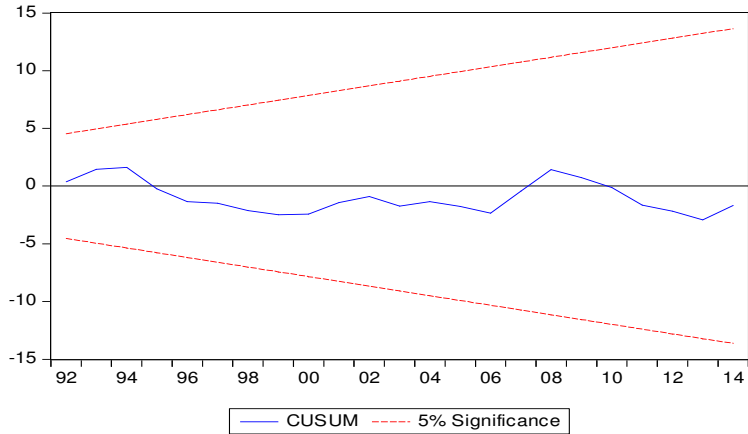
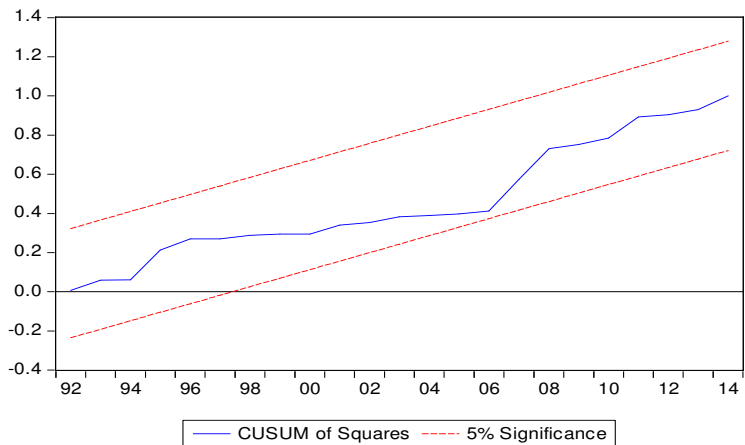


Fig.no. 4. CUSUM of Squares Test



Therefore, this study finds clear evidence suggesting a financial inclusion-dampening effect of high interest rates for Nigeria. Accordingly, there are no financial inclusion-enhancing effects of interest rates when interest rates get above its threshold value. This

shows the nature and extent to which interest rate impacts prospects for financial inclusion in developing countries, most especially Nigeria.

Summary and Policy Implications

This study provides evidence on the non-linear impact of interest rates on financial inclusion. The findings show that developing countries such as Nigeria face high thresholds of interest rates and that high level of interest rate can have negative effects on the level of financial inclusion. The estimated interest rate threshold is 16.9. This threshold is significant at the 0.05 level, based on Bai-Perron (2003) critical values. In other words, the interest rate threshold for financial inclusion in Nigeria is 16.9%. This shows that interest rate is harmful for financial inclusion when interest rates get too high. In other words, high interest rates can deter faster financial inclusion. Thus, the results of this study support financial inclusion-dampening effects of interest rates in Nigeria. The logical conclusion is that Nigeria, and other developing countries as well, with lending interest rates above 16.9 percent should aim to attain interest rate levels that do not deter financial inclusion by adopting policies that drive down interest rates.

This study provides policymakers with a framework with which to launch interventions in credit markets. While capping interest rates may be advisable, such input based solutions distort the market. Hence the market should be left alone to determine the interest rate. The government could support certain key sectors through other alternatives (i.e. output based aid). In the short term, moral suasion can be an effective tool.

Nonetheless to actually drive down interest rates in the long term, governments should build support structures such as business and regulatory environment encouraging the supply of financial services at lower cost and thus push the supply curve of financial services to the right.

The government can as well publish and advertise the lending interest rates of competing banks in the country in order to intensify competition. Competition between financial institutions could compel them to compete on the cost of credit and thus bring down interest rates. Competition can force lenders to improve efficiency. The corollary of this is that governments need to license more financial institutions to encourage competition and bring down rates.

However, more players may not lead to greater competition due to the challenges of the financial sector in Nigeria. In fact, with the high capital requirements and fixed costs, small players may levy higher rates so as to remain profitable. The government needs to adapt and base policy on a comprehensive scrutiny of the market structure, promotion of competition and elimination of preventable barriers to entry (i.e. excessive red tape).

Government may as well help to drive down interest rates through promotion of transparency and financial consumer protection. Transparency in lending practices will ensure that consumers are shielded from hidden costs.

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