

Monetary Policy Rate and Market Interest Rates in Nigeria

Ishaku, Rimamtanung Nyiputen & Magaji Ibrahim Yakubu

Department of Economics, Federal University Wukari, Taraba State, Nigeria

Email: ishakurimantanung@gmail.com, ymagaji@yahoo.com

Abstract

This study investigates the impact of Nigeria's market interest rates on the monetary policy rate (MPR). In order to maintain parsimony, we create two indexes to represent deposit and lending rates, respectively: the short-term interest rate (SINT) and the lending interest rate (LINT). The models used are threshold regression and nonlinear autoregressive distributed lag (NARDL). Monthly data from 2002:M1 to 2019:M12 are used in the study. According to the threshold regression model's results, MPR substantially impacts SINT and LINT over the projected thresholds of 11 and 13 percent, respectively, than it would if it were below the threshold. Additionally, results from the nonlinear ARDL model demonstrate that a drop in MPR hurts lending and short-term interest rates, whereas an increase in MPR has a favorable effect. The extent of the negative impact is negligible for LINT and statistically insignificant for SINT. This illustrates how prices are sticky downward, supporting the claim that MPR is only ineffective when modified downward. To increase the effectiveness of monetary policy, we advise the monetary authority to concentrate on banking sector reforms that eliminate downward rigidities in the impact of MPR on interest rates.

Keywords: interest rate, monetary policy rate, non-linear threshold regression

1. Introduction

The Central Bank of Nigeria, like in several other nations, has long used monetary policy as a crucial framework for enacting the intended macroeconomic goals. The monetary policy rate (MPR) is a crucial tool the monetary authority uses in this context. The minimal rediscount rate (MRR) was replaced by the MPR in 2006 by the Central Bank of Nigeria (CBN), since the MRR was deemed to be relatively unsuccessful. The CBN has used the MPR as one of its monetary policy tools since it was adopted to set goals and guidelines for other rates (Aliyu et al., 2017). Interest rate pass-through (IRPT) is thus one method by which the efficacy of monetary policy can be assessed.

The method by which bank interest rates react to changes in the MPR is known as the IRPT (Rehman, 2009). It is anticipated that the MPR will announce the Monetary Policy Committee's decision and serve as a reference point for other interest rates. Still up for debate, though, is how well the MPR works to affect other interest rates.

Different approaches to evaluating cases, both within and between nations, in order to determine the effectiveness of MPR have produced inconsistent results. Weth (2002) contended that although there are others who contend that IRPT is weak and inadequate in the short term, it is complete in the long term (Aydin, 2007; Marotta, 2009). However, another group argues that, at least for the near term, IRPT is complete (Crespo-Cuaresma et al., 2004).

The Nigerian CBN modifies the MPR as a tool for policy, the CBN of Nigeria modifies the MPR in order to sustain price and monetary stability while promoting economic expansion. The CBN's continued use of this tool indicates that the monetary authority implicitly believes in its efficacy. But there have been doubts about this tool's efficacy. Research has shown that the

MPR does not represent changes in the nation's short- and long-term interest rates (Kelilume, 2014). This claim states that employing monetary policy to achieve macroeconomic goals is impractical since it can have little to no impact on credit control and, by extension, the money supply.

Therefore, a better understanding of the relationship between the MPR and interest rates is essential to Nigeria's monetary policy, given the country's ongoing reliance on the MPR and the argument against its effect on interest rates. However, the scope of Nigerian IRPT literature is still quite narrow. In light of this, this study looks into how the MPR affects a few different market interest rates in Nigeria. Sanusi (2010) asserts that since the banking industry's consolidation, Nigeria's IRPT has gotten even weaker. Therefore, identifying the precise and varied levels at which MPR affects other rates could yield higher value in a period where the need for policy efficacy is growing.

This research is distinct in that it uses a non-linear and threshold regression approach to investigate the previously described link in Nigeria. Studies examining the relationship between Nigeria's policy rate and other market interest rates employ a linear methodology. Ridge regression, structural VAR (SVAR), or vector autoregression (VAR) can be used for this (Sanusi, 2010; Kelilume, 2014; Aliyu et al., 2017; Mordi et al., 2019). These frameworks might be useful for studying interest rate passthrough, but they are unable to identify the non-linear effects of monetary policy—that is, proportionate increases or decreases in other rates. This is the question that this research aims to answer, especially in light of interest rate rigidities (Hannan & Berger, 1991). Evidence for potential disparities in the retail rate adjustment process (savings rate) in response to the monetary policy rate is shown by Mordi et al. (2019). We investigate the impact of a rise and a drop in MPR on other market rates using a non-linear autoregressive distributed lag (NARDL) model. Policy shocks can have different effects in terms of direction, importance, and size. A non-linear analysis like this provides relevant policy insights about the efficacy of a change in the MPR, whether it is positive or negative.

Furthermore, we speculate that the previously described association might be susceptible to different thresholds. Following the 2008 financial crisis, which saw the MPR drop to an all-time low of roughly 6%, the policy rate has risen to over 10% and has been continuously varying between 12% and 4%. As a result, this study adds value by examining how the MPR affects other market interest rates in light of the several ways that it has been altered. As a result, the inquiry can determine whether or not the MPR levels have an impact on other market rates. Finally, in order to maintain parsimony, we created two indices to represent deposit and lending rates, respectively: the short-term interest rate (SINT) and the lending interest rate (LINT). These indices, which combine short- and long-term interest rates into their respective measurements, offer a distinctive depiction of those rates.

In summary, this research offers proof of nonlinearities and the impact of the regime's witching behavior on the MPR. The path in which monetary policy can be implemented to maximize efficacy is clarified by these findings, which are significant for policymakers.

The following are the remaining sections of this paper: In Section 2, styled facts and a review of the literature are presented. An explanation of the data and technique is given in Section 3. Section 4 examines and presents the findings, while Section 5 provides the study's conclusion and some policy recommendations.

2. Literature Review

2.1 Theoretical Literature

The method by which the MPR transmits to different interest rates is known as interest rate pass-through (IRPT) (Rehman, 2009; Kovanen, 2011). This section discusses the primary points of contention and methods used in the theoretical literature. All of these ideas concur that MPR plays a significant role in figuring out other interest rates. Their differences lie in the way or extent to which MPR affects market rates.

Monti and Klein's (1971) typical theoretical model is used to analyze how MPR affects market rates. According to this concept, assuming markets are perfectly competitive, the IRPT will react to the monetary policy rate quickly and entirely symmetrically. This model is predicated on the notions that there is no switching cost, information asymmetry, and imperfect competition in the financial markets. As a result, full pass-through is considered a long-run phenomenon, with short-term deviations from the long-run equilibrium.

For several reasons, IRPT can be determined to be sticky, complete or incomplete, symmetric or asymmetric. Under asymmetric IRPT (Stiglitz & Weiss, 1981; De Bondt, 2005), banks may choose to pass on the cost of an increase in the policy rate to borrowers by increasing the bank rate in addition to the policy rate increase in order to offset the risk. There is a chance that something else will happen, and the interest rate won't rise in response to a rise in the policy rate. The rationale behind this is that a rise in bank rates is likely to deter low-risk borrowers, hence creating an adverse selection environment where high-risk borrowers are more inclined to engage in high-risk activities, or moral hazard. To put it another way, when lending rates rise, borrowers often take on riskier ventures. Because asymmetric knowledge exists, bankers ration loans to achieve equilibrium in the loan market rather than raising their rates above the increase in the policy rate. This combination of possibilities proves to be asymmetrical.

Furthermore, financial frictions can cause enormous swings in economic activity, which in turn influence retail rates, as demonstrated by Bernanke et al. (1996). If there is an information asymmetry and lenders are unable to differentiate between borrowers who pose a low or high risk, they will require all borrowers to pledge collateral.

Thus, a rise in the policy rate, indicating a tightening of monetary policy, devalues the borrowers' assets and makes it harder for them to borrow money for investments. A vicious cycle develops whereby a weakened economy further depresses asset values, which in turn causes tighter lending terms that further curtail economic activity. In such a vicious cycle, the policy rate may trigger an overpass-through on retail rates.

Macroeconomic factors also influence retail rates' stickiness (Egert et al., 2007; Egert & Macdonald, 2009). Policy signals lose some of their informational value when macroeconomic conditions are highly volatile. As a result, bankers may decide to implement gradual interest rate parity (IRPT). On the other hand, during times of significant macroeconomic volatility (high inflation), interest rate passthrough may occur more quickly. Banks try to modify their rates in response to rapidly fluctuating prices in order to maximize their profit; as a result, IRPT is quicker.

Menu cost provides an additional explanation for interest rate stickiness (Rotemberg & Salone, 1987). According to the menu-cost theory, banks will only change their rates if the benefits outweigh the associated costs (such as new price list advertising and communication costs). Stated differently, slight variations in policy rates could result in a postponed or negligible shift in retail rates.

Retail rate rigidity can also be attributed to changing costs, according to Lowe and Rohling (1992). If the expense of switching banks offsets the impact of the bank's higher interest rate, customers may find switching to be more expensive. Therefore, a high switching cost could be a sign of both asymmetric adjustment and stickiness in retail prices.

On the other hand, banks would probably give their customers implicit contracts with more stable interest rates if they wanted to maintain their long-term ties with them (Fried & Howitt, 1980; Berger & Udell, 1992).

The ownership structure of the financial sector may also have an impact on interest rate pass-through (Grigoli & Mota, 2017). When it comes to political considerations and inefficiencies, state-owned financial institutions that prioritize policy over profit may opt to postpone interest rate changes.

Analogously, collusive oligopolistic behavior could result from a financial system controlled by a small number of banks (Hannan & Berger, 1991). The collusive conduct hypothesis states that because higher deposit rates mean higher costs for banks, they may stiffen up after an increase in the MPR. Likewise, as lower lending rates translate into lower bank profits, lending rates may exhibit downward rigidity in response to monetary policy rate reductions.

In conclusion, the previously discussed ideas show that the usual theoretical model for analyzing the effects of MPR on market rates may not always adhere to the perfectly competitive market premise. The speed at which MPR influences other interest rates is determined by a variety of micro- and macroeconomic parameters, according to a survey of the theoretical literature on IRPT. Furthermore, a number of these factors are outside the purview of policymakers, which helps to explain why the monetary policy rate is ineffective in influencing other rates and, consequently, the results of macroeconomic aggregates.

2.2 Empirical Literature

The majority of IRPT empirical research focuses on the extent and rate at which changes in money market rates affect banking rates, as well as the differences between short- and long-term shifts in market interest rates relative to monetary policy rates. The methodologies and scope of these studies vary, depending on whether they focus on cross-national or individual behavior.

Tai et al. (2012) looked into how different Asian countries' lending and deposit rates were from the monetary policy rate in terms of pass-through. Using an apparently unrelated regression (SUR), the research revealed that although the pass-through to the lending rate is marginally higher than the deposit rate, the transmission rate is slow. Examining the impact following the dot-com collapse in 1997, the research revealed that most countries saw a significantly slower rate of adjustment.

Slovenia, Slovakia, Poland, Hungary, and the Czech Republic are the five Central and Eastern European nations (the CEE-5) that Egert et al. (2007) studied using the IRPT. The study's conclusions supported the empirically known fact that IRPT is significantly greater for corporate lending rates and short- to long-term deposits but significantly lower for overnight rates. The study's main result was that the pass-through was larger for the CEE-5 countries than for other core euro-area countries. However, over time, the pass-through in the CEE-5 looked to drop, indicating that the rise in heterogeneities in the euro-area had stopped.

In the Central African Economic and Monetary Community, Samba and Yan (2010) investigated the monetary transmission mechanism of the interbank rate of return (IRPT) from short-term interest rates to long-term rates. The policy rate had an extremely low and imperfect long-run pass-through to the deposit rate, according to the findings. However, they discovered a significant overshooting effect on loan rates.

Yildirim (2012) looked into the possibility of asymmetric lending rate movement in Turkey as a result of monetary policy and financial market conditions. The study, which used threshold autoregressive models (TAR), discovered that there are significant asymmetries and that banks react more slowly to a decrease in money market rates than they do to increases in them. Additionally, sectoral heterogeneities were discovered, indicating that banks' resistance to trailing declines in money market rates differs depending on the lending rate.

Using a comparable econometric technique (the TAR model), Tang et al. (2015) looked at the policy rate pass-through effect on retail rates in Malaysia. The study discovered downward rigidities in the response of both lending and deposit rates, in addition to incomplete policy rate pass-through to deposit and lending rates. The findings of Levine and Loeb (1989), Dueker (2000), and Tkacz (2001) are supported by these data. Similarly, Grigoli and Mota (2017) investigated the inequalities in the retail rate adjustment to changes in the monetary policy rate for the Dominican Republic using the same technique. It discovered a complete pass-through, in contrast to the earlier research, indicating the efficacy of the monetary policy transmission mechanism. Different findings, meanwhile, show that while lending rates respond more quickly to policy rate decreases, deposit rates respond more quickly to policy rate hikes.

There aren't many studies (Sanusi, 2010; Mordi et al., 2019; Aliyu et al., 2017; Kelilume, 2014) on how monetary policy affects market rates in Nigeria, and most of them focus on the size and speed of the effect. Kelilume (2014) used the multivariate vector autoregressive (VAR) model to study the impact of MPR on both short- and long-term interest rates. The results show that there was little monetary policy transmission to interest rates in Nigeria. The analysis discovered that while the pass-through to the maximum lending rate and the savings rate was incomplete, the pass-through to the interbank, Treasury bill, and prime lending rates was complete. The results underscored the possibility that an inadequate incentive framework could account for the inadequate and partial monitoring of the savings rate.

The impact of MPR on Nigeria's short- and long-term interest rates was studied by Aliyu et al. (2017). The study discovered that the Monetary Policy Rate has the greatest influence on Treasury bill and interbank rates by utilizing a combination of models (principal component, ridge regression, and OLS). Nonetheless, it discovered a statistically negligible and negative correlation between lending rates and the MPR. This begs the question of whether lending rates should continue to be determined by the MPR.

Similarly, Sanusi (2010) calculated the size and rate of the interbank rate differential (IRPT) between the retail and deposit interest rates in Nigeria and the monetary policy rates using a structural VAR (SVAR) approach. According to the report, pass-through in Nigeria is typically delayed and incomplete. However, compared to retail lending and deposit rates, the MPR to the interbank rate is much higher and occurs much faster. Additionally, during the post-consolidation period, the MPR's pass-through to money market rates rose; but, in contrast to the pre-consolidation period, the pass-through to retail and deposit market rates fell. Therefore, the study comes to the conclusion that despite financial sector changes, inefficiencies in the retail and deposit markets persisted, making monetary policy ineffectual and inefficient.

Moreover, Mordi et al. (2019) looked at the MPR's interest rate pass-through magnitude and adjustment pattern to a few selected Nigerian retail interest rates. The study used an error correction model (ECM) technique to take asymmetric adjustment and structural breaks into consideration. The results demonstrated notable structural fractures as well as a long-term link between the prime lending and savings rates and the monetary policy rate. However, the results showed that the retail rates were rigidly adjusted in response to the monetary policy rate, leading to incomplete IRPT. Furthermore, all other retail rates, with the exception of the savings rate, adjust symmetrically, suggesting that the way savings rates react varies based on changes in MPR. Stated differently, positive shocks to MPR react to changes in savings rates more quickly than negative shocks.

Moreover, Tule (2014) used a VAR model to evaluate how responsive Nigeria's short-term interest rates were to shifts in the monetary policy rate. According to the study, the 3-month deposit rate and the Treasury bill rate have lower long-term interest rate parity to money market rates than do the maximum and prime lending rates. According to the findings, structural rigidities that could impede the transmission of monetary policy signals may be indicated by the variations in impact. Additionally, banks give fluctuations in the interbank rate more weight when assessing their choices about their marginal cost of funds in an effort to make up for these deficiencies.

The pass-through of MPR on other interest rates has been studied in the literature for IRPT in Nigeria using a variety of econometric techniques, such as OLS, VAR, SVAR, ridge regression, and ECM. Even while the results concur on the stickiness and incompleteness of the MPR influence on other rates, their applicability is still constrained. The IRPT of MPR and other rates were primarily treated as linear in Nigerian studies, while there may actually be a non-linear relationship.

Using data that ended in 2014, Mordi et al. (2019) demonstrated the likelihood of asymmetry in the retail rates' (savings rate's) adjustment process in response to the monetary policy rate. Nevertheless, our research broadens the focus to encompass significant eras characterized by recent economic recessions. We investigate the significance, amplitude, and direction of an increase or drop in MPR on other market rates using a non-linear autoregressive distributed lag (NARDL) model. According to research by Mordi et al. (2019), the majority of lending rates—aside from savings rates—respond symmetrically to shifts in MPR.

In this work, we use principal component analysis to aggregate these various rates into an index for parsimony. The index, which stands for short-term deposit rates and lending rates, respectively, is referred to in the study as the short-term interest rate (SINT) and lending interest rate (LINT). This index, which compiles data on the chosen lending and short-run interest rates

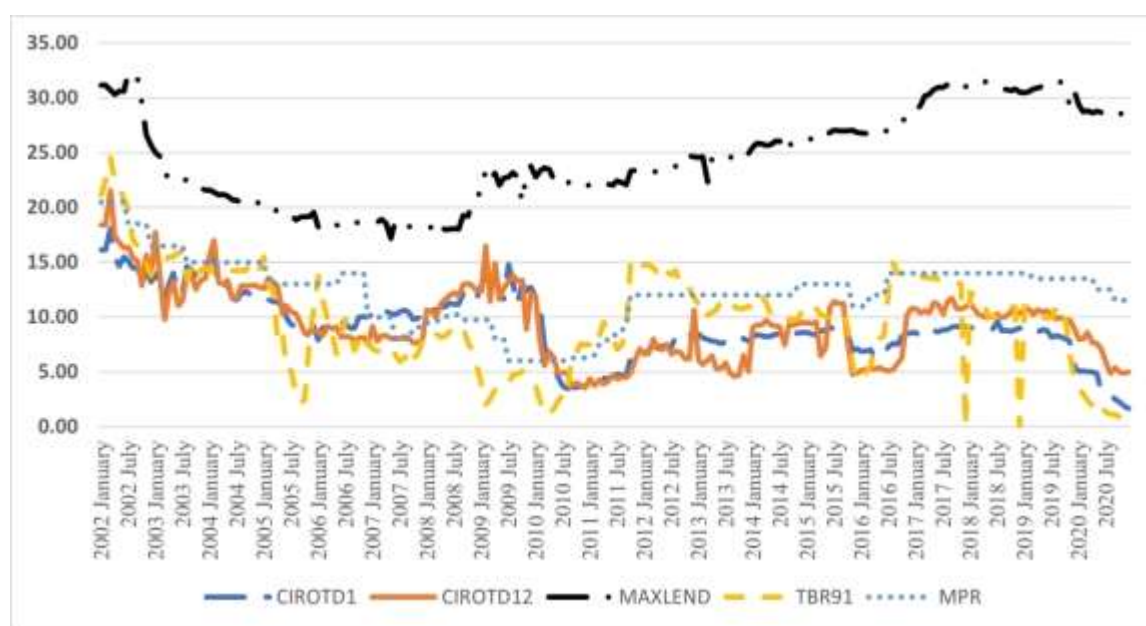
into distinct indices, is a unique depiction of the two types of interest rates. Furthermore, as Sanusi (2010) noted, Nigeria's IRPT has weakened even more since the banking sector consolidation. As a result, in an era where policy effectiveness is becoming more and more important, greater value could be harnessed by using threshold analysis to examine the various levels at which MPR influences other market rates.

In order to achieve this, this study contributes to the IRPT literature by utilizing a threshold and non-linear analysis to further explore how short-term deposit rates in Nigeria react to changes in the monetary policy rate. This study is distinct from previous studies in the literature because it aims to investigate potential nonlinear impacts in addition to the implications of the monetary policy rate's regime-switching behavior. Because it clarifies the direction that monetary policy can be used to achieve greater efficacy, this study is relevant to policy.

2.3 Stylised Facts

This section delves deeper into concerns about MPR's effectiveness by examining how the rate behaves in relation to many other market rates and important macroeconomic variables. As demonstrated in Figure 2, the domestic macroeconomic situation from 2002 to 2005 was marked by relatively stable Naira exchange rates, a gain in foreign reserves, and both significant rises and decreases in real GDP. But in 2006, there were disruptions like oil pipeline vandalism in the oil-producing region, which had an impact on oil production and earnings and decreased GDP growth (CBN Communique, 2006). Furthermore, a rise in the inflation rate was another feature in 2006. The monetary policy committee (MPC) chose to keep the cash reserve ratio (CRR) at 5% while raising the MRR from 13% to 14% (see Figures 1 and 2). This move was made in an effort to maintain price stability. When the inflation rate started to decline in June 2007, that's when this rate was examined (CBN Communique, 2007).

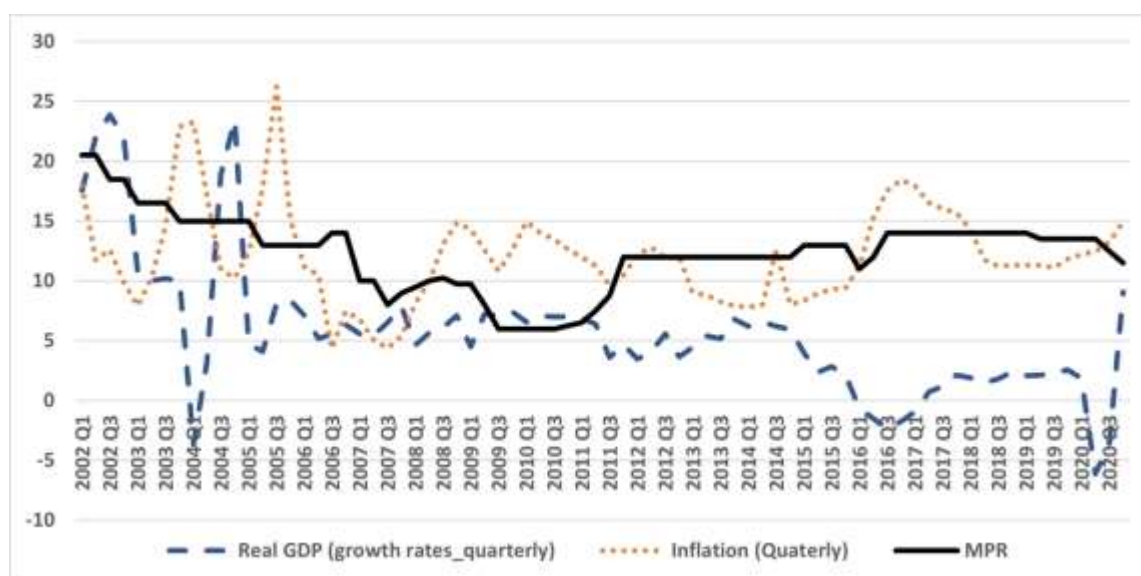
Figure 1. Interaction Between MPR and some selected market rates.



In 2014, the Nigerian macroenvironment remained robust and resilient, with a degree of stability in pricing and output, notwithstanding the decline in oil prices that was partly caused by the shale oil revolution (CBN Communique, 2014).

As a result, the financial system's liquidity increased. The banking system's improved liquidity circumstances, intended to increase its resilience and stability, did not result in an increase in credit availability to the real sector because of incomplete interest rate pass-through. Rather, when the liquidity conditions improved, inflation increased (refer to Figure 2). The MPC agreed to implement a tightening measure by raising the MPR to 13% from 12% in order to reduce these inflationary impacts (CBN Communique, 2014). Between 2014 and 2016, the MPR saw shifts in several directions due to both internal and international events (see Figures 1 and 2). One such instance is the Brexit vote, which exacerbated volatility and fragility in the world's financial system (CBN Communique, 2016). Domestically, there was a consistent increase in MPR from 11–12% and 12–14%, respectively, in March and July of 2016 (CBN Communique, 2016). This was done to reduce the steadily rising inflationary pressure (as shown in Figure 2), which was brought on by a shortage of gasoline, higher energy tariffs, a lack of foreign exchange, and the high cost of factor inputs related to the nation's economic downturn at the time.

Figure 2. Communication between a few chosen macroeconomic variables and MPR.



Nonetheless, 2019 saw a number of significant international developments, including the US-China trade war, a decrease in global output, ongoing ambiguity surrounding the BREXIT negotiations, regional wars in the Middle East, and a slowdown in China's output growth (CBN Communique, 2019). The domestic economy was steady despite these global headwinds, with a modest increase in real GDP and a moderate drop in headline inflation (see Figure 2). With the exception of a minor decrease from 14 to 13.50% in March 2019, the MPR was therefore maintained for the majority of the periods (CBN Communique, 2019).

The CRR was increased from 22.5-27.5% in January 2020 due to the ongoing inflationary pressure that resulted from the border closure in 2019 (which stood at 11.98% as of December 2019) (CBN Communique, 2020). However, the ongoing coronavirus spread resulted in

exchange rate volatility, rising public and corporate debt, rising unemployment, tightening financial conditions, reversals in capital flows, negative shocks to commodity prices, and a slowdown in global industrial activity. As a result, the MPC decided in May 2020 to lower the MPR from 13.5–12.5% (refer to Figures 1 and 2) in an effort to mitigate some of the COVID-19 pandemic's effects.

3. Research Method

3.1 Data

Secondary data from the Central Bank of Nigeria Statistical Bulletin for 2020 was used in the study. It spans the monthly years 2002–M1 through 2019–M12. The money supply (M2), lending interest rate (LINT), monetary policy rate (M1), and short-term interest rate (SINT) index are among the variables that are taken into account. Principal component analysis is utilized in the computation of the short-term interest rate index is calculated using principal component analysis. There are two computed indices. LINT is the lending rate, and SINT is the short-term savings rate. The interest rates on time deposits from commercial banks maturing for seven days (CIROTD7), one month (CIROTD1), three months (CIROTD3), six months (CIROTD6), and twelve months (CIROTD12) are the variables used for SINT computation. These interest rates are thought to fall into the short-term interest rate category because of their maturity durations. LINT is computed using the prime lending rate (PLR) and the minimum lending rate (MLR) are the variables used in the computation of LINT. Because of its theoretical relationship to interest rates, the money supply (M2) acts as a control variable in the model (Mishkin, 1996).

Analysis of Principal Components (PCA) A multivariate statistical method called principal component analysis (PCA) is used to condense a set of data's variables into a significant number of dimensions (Abdi & Williams, 2010). PCA takes an initial set of n correlated variables and turns them into a set of uncorrelated components. Each component is a linearly weighted combination of the initial set of variables. Considering a collection of variables X_1 – X_n ,

$$PC1 = a_{11}X_1 + a_{12}X_2 + \dots + a_{1n}X_n$$

...

$$PCm = a_{m1}X_1 + a_{m2}X_2 + \dots + a_{mn}X_n$$

in such a way that a_{mn} stands for the weight of the n th variable and the m th principal component. The associated matrix's eigenvectors provide these weights. The eigenvalue of the appropriate eigenvector yields the variance for each primary component. Under the condition that the total of the squared weights ($a_{211} + a_{212} + \dots + a_{21n}$) equals 1, these parts are organized so that the first part explains the greatest amount of variation in the original.

3.2 Theoretical Framework

The marginal cost pricing model is the theoretical framework that was used for the investigation (De Bondt, 2005). This is in accordance with the Monti-Klein framework (Monti 1971; Klein 1971), which postulates the existence of a perfectly competitive market devoid of menu costs, transaction costs, and asymmetric knowledge, where price equals marginal cost. Under such circumstances, the marginal change in price relative to the marginal cost equals unity. Stated differently, the transfer is direct because the official rate accurately represents the underlying

cost of financing. The relationship between the different market rates and the monetary policy rate is represented by the following model when the framework is applied algebraically:

$$MR_t = a + b \cdot MPR_t + e_t \quad (1)$$

where MR represents the market interest rates (SINT; LINT), MPR is the monetary policy rate, a is the constant mark up and b is the coefficient for the interest rate pass-through. Under a perfectly competitive market, the MPR coefficient, b, would equal unity. Lastly, e is the error term. In this study, equation 1 extends the existing theoretical model by considering nonlinear relationship as discussed in the model specification.

3.3 Model Specification

The study's analysis made use of non-linear ARDL models and Hansen's (1999) threshold regression estimate approach. The non-linear ARDL helps figure out how changes in MPR affect short-term interest rates in a way that isn't linear, as well as how strong and important those effects are. The threshold regression, on the other hand, lets you switch between regimes, which helps you figure out how MPR affects interest rates at a certain level.

3.3.1 The Threshold regression

The threshold estimation technique is chosen for the investigation instead of Markov switching models because of two key conceptual distinctions. There are two things to note: while regime changes in threshold regression are preset, they are endogeneous in Markov switching models. Firstly, Markov switching models integrate less prior knowledge than threshold regression. Because of the additional disturbances in the Markov evolution equation, changes in Markov switching could not be reliably predicted from historical data, even if the model parameters were known (see Koop & Potter, 1999). Assume that the following linear model describes the relationship between MPR and other interest rates.

$$r_t = \mu_0 + \mu_1 MPR + bM_2 + e_t \quad (2)$$

where r_t stands for the interest rates (SINT and LINT), MPR_t , the monetary policy rate (the threshold variable), M_2 , money supply, and e_t , the error term in the model. μ_0 ; μ_1 and b are the regression parameters. According to Hansen's (1999) framework, equation (1) can be respecified to accommodate threshold components. To model the Hansen framework with Equation (2), a threshold is established using MPR, such that MPR is equal to or less than the threshold, as well as greater than the threshold, is measured against the interest rate as shown in equation (3) below:

$$r_t = \mu_0 + \mu_1 MPR_{tr} (MPR \leq 1) + \mu_2 MPR_{tr} (MPR > 1) + bM_2 + e_t \quad (3)$$

where MPR is the threshold variable, and it is adopted to test for the presence of the threshold effect of MPR on interest rates. 1 is the threshold parameter, and $I(.)$ elicits the function that assumes unity (1) if MPR is lower than or equal to the determined threshold value (1) and 0 otherwise. A complete effect would occur if a unit increase in MPR results in a unit or more than a unit increase in I, that is, if μ_1 and μ_2 are each greater than or equal to one. Otherwise, the effect is incomplete. Equation (2) can also be partitioned into two regimes, depending on whether the threshold variable is lower than or higher than the estimated threshold. These regimes are isolated by different regression parameters in μ_1 and μ_2 as follows:

$$r_t = \mu_0 + \mu_1 MPR_t + bM_2 + \varepsilon_t ; \text{ if } MPR \leq \lambda \quad (4)$$

$$r_t = \mu_0 + \mu_2 MPR_t + bM_2 + \varepsilon_t ; \text{ if } MPR > \lambda \quad (5)$$

Equations 4 and 5 represent the regime below and above the threshold, respectively. Money supply (M_2), which is a control variable in the model, is regime-invariant.

The ordinary least square method is used to estimate the threshold in equation 3, and the sum of squared errors (S_1) is found for all the threshold variables in the model that can be estimated. S_1 is computed as $\sum (y_t - \hat{y}_t)^2$ (this reflects the sum of square error in matrix notation, identifying the gap between the mean observation and its

group mean). Next, the threshold parameter is obtained by minimizing (S_1), such that $\hat{\lambda} = \arg \min_{\lambda} S_1(\lambda)$ (that is, the parameter for the threshold variable is obtained by minimizing the sum of the squared errors). It is important to test if the endogenous threshold is statistically significant once it has been determined. The null

Hypothesis: There is no threshold effect ($H_0: \lambda_1 = \lambda_2$). This implies that the slope coefficients are similar in the two regimes. Hence, under H_0 , equation (3) is similar to the linear model in equation (2). The likelihood ratio test for the null hypothesis is based on the F-statistic: $F_1 = (S_0 - S_1(Y)) / a^2$ where S_0 and S_1 represent the sum of squared errors under the null hypotheses, and a^2 is the estimate of the regression error variance (σ^2). Because the threshold value is not identified under the null hypotheses, the asymptotic distribution of F_1 is not standard. To address this, Hansen (1999) suggests a bootstrap method to simulate the probability value for the F-statistic (F_1). For a threshold to exist, it is expected that, from equation (3), μ

Non-linear ARDL model

Shin et al. (2013) created the non-linear ARDL (NARDL) model. It is the conventional ARDL model's asymmetrical expansion, created by Pesaran et al. (2001). One benefit of the ARDL model is that it can produce reliable results when the series are $I(0)$, $I(1)$, or a combination of the two. It also lets you include both independent and dependent factors in the model, and it might be possible to fix endogeneity in the explanatory variables (Caporale & Pittis, 2004). The classic ARDL model, from which the NARDL is formed, is described in the paper, as the NARDL is the asymmetrical derivative of the linear ARDL model. The ARDL model is given two variables, x and y , as follows:

$$\Delta y_t = \sum_{i=1}^q a_i \Delta y_{t-i} + \sum_{j=0}^p \beta_j \Delta x_{t-j} + \gamma_1 y_t + \gamma_2 x_t + \varepsilon_t \quad (6)$$

Following the work of Shin et al. (2013), NARDL can be derived from equation 6 by replacing x_t with (X^+) and (X^-) in the linear ARDL model as follows:

$$\Delta y_t = \sum_{i=1}^q a_i \Delta y_{t-i} + \sum_{j=0}^p \beta_{1j} \Delta x_{t-j}^+ + \sum_{j=0}^p \beta_{2j} \Delta x_{t-j}^- + \gamma_1 y_t + \phi_1 x_t^+ + \phi_2 x_t^- + \varepsilon_t \quad (7)$$

Equation (7) can be reparametrized to incorporate the variables of interest as follows:

$$\Delta r_t = \sum_{i=1}^q \alpha_i \Delta r_{t-i} + \sum_{j=0}^p \beta_{1j} \Delta MPR_t^{+j} + \sum_{j=0}^p \beta_{2j} \Delta MPR_t^{-j} + \sum_{j=0}^p \beta_{3j} \log(M2)_t \gamma_{1j} r_t + \phi_1 MPR_t^{+} + \phi_2 MPR_t^{-} + \phi_3 \log(M2)_t + \varepsilon_t \quad (8)$$

The independent variable is decomposed into positive (X^{+}) and negative (X^{-}) changes in Shin *et al*, (2013) as follows:

$$MPR^{+}_t = \sum_{k=1}^t \Delta MPR^{+}_k = \sum_{k=1}^t \max(\Delta MPR_k, 0) \quad (9)$$

$$MPR^{-}_t = \sum_{k=1}^t \Delta MPR^{-}_k = \sum_{k=1}^t \min(\Delta MPR_k, 0) \quad (10)$$

Equations (9) and (10) isolate the positive and negative changes in the policy variables in the model, where X is a vector of policy variables in the model.

4. Findings and Discussions

Table 1 below shows the descriptive characteristics of the series used in the models. The nation experienced an average monetary policy rate (MPR) of 12.29 percent during the study period, with a minimum rate of 6 percent and a maximum rate of 20.5 percent. It is anticipated that this rate would affect other market interest rates. A high short-term interest rate ought to follow a high MPR, and vice versa. During the study period, the average rate of the short-run interest rate (SINT) was 17.67 percent, with a minimum of 14.58 percent and a maximum of 26.38 percent. Additionally, during the study period, the lending interest rate (LINT) had an average rate of 30.19 percent, with a low of 25.65 percent and a maximum of 30.68 percent. Throughout the periods, the wide money supply similarly showed a mean value of roughly NGN12.3 trillion, with a minimum of NGN 1.3 trillion and a maximum of NGN 29.1 trillion.

Table 1. Descriptive statistics

	MPR	M2	SINT	LINT
Mean	12.29	12232.221	17.67	30.187
Median	13.00	11543.528.00	17.00	30.675
Maximum	20.50	29137.800	26.38	32.270
Minimum	6.00	1347.266	14.58	25.650
Std. Dev.	3.19	8356.076	2.27	2.036
Skewness	-0.08	0.28	2.06	-1.348
Kurtosis	3.32	1.84	7.80	3.572

Jarque-Bera	1.16	15.05	360.36	3.796
Probability	0.56	0.00	0.00	0.150
Observations	216.00	216.00	216.00	362.240

The main components of the lending interest rate (LINT) and the short-term interest rate indicator (SINT) are displayed in Table 2. According to the findings, the first component (CIROTD7) explains 93% of the variance in the five short-term interest rates, with the remaining four components explaining only 7% of the variance. In a similar vein, the first component (PLR) becomes the dominant component of the two lending interest rates.

Table 2. Principal components analysis (PCA) result

Component	Eigenvalue	Proportion	Cumulative
SINT			
CIROTD7	4.683	0.937	0.937
CIROTD2	0.205	0.041	0.978
CIROTD3	0.071	0.014	0.992
CIROTD6	0.032	0.006	0.998
CIROTD12	0.009	0.002	1.000
LINT			
PLR	1.208	0.604	0.604
MLR	0.792	0.396	1.000

Table 3 presents the series' stationarity properties using the Augmented-Dickey method. Fuller and Philip-Peron tests. It shows that the series is stationary only at first. Difference in both tests. The ARDL model is well suited for series-containing models. of this stationarity feature (Pesaran et al. 2001). Hence, the ARDL model is adopted for the study.

Table 3. Unit root test

variables	ADF		PP		I(d)
	diff	first	diff	first	
	levels		levels		
SINT	-3.038	-16.894***	-3.003	-16.817***	I(1)
M2	-2.742	-16.506***	-2.518	-16.751***	I(1)
MPR	-2.266	-14.556***	-2.266	-14.556***	I(1)
LINT	-3.541**	-14.947***	-3.932***	-15.042***	I(0)

***, **, * denote significance at 1%, 5%, and 10% respectively.

Table 4 is the correlation matrix for the variables in the model. It shows that there is a correlation 1. There is a relationship between short-term interest rates (SINT), lending interest rates (LINT), and money. The supply (M2) and monetary policy rate (MPR) are relatively low, so they can be combined into the same model without generating a spurious result.

Table 4: Correlation matrix

Variables	SINT	MPR	M2	LINT
SINT	1			
MPR	0.555 (0.000)	1		
M2	-0.499 (0.000)	-0.076 (0.266)	1	
LINT	-0.109 (0.000)	0.449 (0.000)	0.705 (0.000)	1

Note: (i) The values in parenthesis are probability values; (ii) because of the possibility of multicollinearity, we were unable to include more variables in the model due to the high correlation we found between these variables and the other independent variables. As a result, we eliminated them from the study to prevent erroneous regression results (see Table A1 in the appendix).

The bound test findings are displayed in Table 5 and indicate if there is a long-run relationship between the two models. At the five percent significance level, the F-statistics are greater than the upper bound critical value. The investigation comes to the conclusion that there is a long-term relationship between the variables as a result of rejecting the null hypothesis that there isn't one

Table 5: Bound test – Null Hypothesis: No long-run relationship

Test Statistic	Value	Significance	I(0)	I(1)
Dependent Variable: SINT				
F-statistic	4.2495	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.50%	3.55	4.38
		1%	4.13	5
Dependent Variable: LINT				
F-statistic	4.549	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.50%	3.15	4.08
		1%	3.65	4.66

Table 6 displays the threshold regression results, which also highlights a significant turning point in the relationship between MPR, the lending interest rate (LINT), and the short-term interest rate (SINT). The model sets the threshold at 11 and 13 percent, respectively. The degree of MPR's impact on the short-term interest rate is now seen to be shifting. MPR below the 11 percent cutoff has a 0.3 percent impact on SINT. In other words, at these levels, a percentage increase in MPR is predicted to raise SINT by 0.3 percent, indicating that MPR has a partial impact on SINT.

In the case of LINT, the effect is insignificant. MPR below the 13 percent cutoff has a 0.0 percent influence on LINT. In other words, at current levels, a percentage increase in MPR is predicted to result in a 0.0 percent increase in LINT, basically indicating that MPR has no influence on LINT.

Conversely, if MPR exceeds the 11 percent threshold, it has a 0.65 percent impact on SINT. In this regime, a percentage point increase in MPR results in a 0.65 percent increase in SINT. Because the coefficient of MPR in this regime is less than unity, the pass-through is insufficient. Similarly, MPR exceeding the 13 percent cutoff affects LINT by 0.51%. In this regime, a percentage point increase in MPR results in a 0.51 percent increase in LINT. Because the coefficient of MPR in this regime is less than unity, the pass-through is insufficient. However, the effect is more pronounced and meaningful when compared to the alternative regime.

Furthermore, for the short-term and loan interest rate models, respectively, the degree of the MPR regime's effect above the 11 and 13 percent barrier surpasses the size of the effect when the MPR regime is below these thresholds. The findings therefore suggest price stickiness below the threshold, with the degree of stickiness varying according to the SINT or LINT market interest rate being studied. Furthermore, the MPR threshold for LINT is larger than that of SINT, suggesting that at lower MPR levels, lending rates are considerably less responsive to MPR than deposit rates. However, in comparison, SINT and LINT react to MPR rates that are higher than their respective thresholds.

These findings have policy implications because they suggest that MPR can be critical to the CBN's goal of price stabilization. This is due to the fact that a higher MPR translates into a higher SINT, which raises the cost of keeping money and may indicate a decrease in overall economic liquidity, both of which have an impact on the level of aggregate prices. The findings also suggest that the monetary authority has limited leeway to lower lending rates in the economy by utilizing the MPR. Changes in the loan rate are generally unaffected by MPR rates lower than 13 percent.

Table 6. Threshold regression result

Dependent Variable	SINT		LINT	
	regime 1	regime 2	regime 1	regime 2
	(MPR < λ)	MPR $\geq \lambda$	MPR < λ	MPR $\geq \lambda$
MPR	0.300	0.651***	0.000	0.513***
LOG(M2)	-2.034***	-0.601***	1.398***	1.062***
C	29.745***	0.9402	-2.307***	-2.384***
Identification of thresholds				
λ	11		13	
Other diagnostics				
R-sqr	0.64		0.89	
adj. R-sqr	0.64		0.89	
F-stat	75.89***		374.61***	

N.B ***, **, * denote significance at 1%, 5%, and 10% respectively

Table 7 illustrates the asymmetric impacts of MPR and money supply (M2) on SINT and LINT. The regression's findings show that SINT and LINT are only partially affected by changes in the MPR, both positive and negative. A decrease in MPR results in a minor reduction in SINT, whereas an increase in MPR raises the short-term interest rate significantly. SINT increases by

approximately 0.13 percent for every percentage increase in MPR. Furthermore, a drop in MPR lowers SINT by 0.06 percent, which is minimal. Conversely, a fall in MPR results in a considerable reduction in LINT, while an increase in MPR very slightly and insignificantly raises the lending interest rate. For every percentage increase in MPR, about 0.01 percent more LINT is produced. Furthermore, even when LINT is only reduced by 0.04 percent, a drop in MPR has a considerable impact.

The non-linear effects of MPR on SINT and LINT were theoretically expected; however, MPR has a statistically non-significant negative effect on SINT and a statistically significant positive effect on LINT. Mordi et al. (2019) could only demonstrate the potential for disparities in the retail rate adjustment process (savings rate in particular) in response to MPR changes. Nonetheless, this study's conclusions show that there is a non-linear influence on lending and short-term interest rates.

The significant impact of a negative shift in MPR on lending rates is noteworthy. Nigerian practical experience indicates that prices are downwardly sticky. In fact, a tiny coefficient of the negate MPR change supports this sensation. The "small" effect is nonetheless noteworthy. The results of the principal component analysis indicate that prime lending rates are higher than maximum lending rates, which may help to explain this. Since the majority of credit borrowers in Nigeria employ the prime lending rate, these borrowers really have significant bargaining power to negotiate a reduction in lending rates in reaction to a decline in the MPR because of their sheer dominance in the borrowers' market.

Additionally, the theoretical literature suggested that prices could be sticky downward, which would account for the possibility that SINT would not be significantly impacted by a downward revision in MPR in this particular instance. These distortions occur in Nigeria as a result of oligopolistic behavior, asymmetric information, and high switching costs. A lack of consumer creditworthiness data contributes to asymmetry by making it difficult for banks to determine customers' risk profiles and, consequently, lending amounts (Sanusi, 2010). The absence of feasible alternatives for depositors to replace their bank savings gives rise to switching costs. The collusive actions of the few institutions that control the majority of the banking sector further strengthen this cost. Banks' pursuit of short-term profits contributes to this by shortening the banking system's liquidity cycle and limiting the opportunities for long-term lending and genuine investments (Tule, 2014; Itaman & Awopegba, 2021). Regarding the model's goodness of fit, the adjusted R-squared indicates that around 93% of the variation in SINT can be explained by both positive and negative changes in the money supply and MPR. The Durbin-Watson test proves that there is no serial correlation in the model, and the F-statistic validates the parameters' joint significance.

Table 7. NARDL model result

Variable	SINT Coefficient (S.E) P-value	LINT Coefficient (S.E) P-value
MPR POS	0.135 (0.063)**	0.013 (0.009)
MPR NEG	-0.061 (0.039)	-0.042 (0.022)*
log(M2)	-0.022 (0.01) **	0.112 (0.200)
C	0.116 (0.072)	-0.612 (1.223)
R-squared	0.933	0.982

Adjusted R-squared	0.930	0.981
S.E. of regression	0.250	0.136
Sum squared resid	12.636	3.405
Log likelihood	-1.888	116.870
F-statistic	314.240	1117.601
Prob(F-statistic)	0.000	0.000
Durbin-Watson stat	2.034	2.210

N.B ***, **, * denote significance at 1%, 5%, and 10% respectively

5. Conclusion

This research investigates the impact of MPR on Nigeria's market interest rates. The precise goals come in two different shapes. We looked at the nonlinear link between MPR and other market rates first, and then we looked into the point at which this influence becomes noticeable. The short-term interest rate (SINT) and the lending interest rate (LINT) were developed as two relevant measures.

To accomplish the two goals of the investigation, we used threshold regression and nonlinear ARDL models. According to the Monti-Klein theoretical paradigm, a complete effect cannot be deduced until the coefficient indicating MPR is unity.

In both models, the estimates were less than one, suggesting that MPR has a partial impact on lending and short-term interest rates. These findings support the widely accepted literature that MPR in Nigeria does not fully flow through to interest rates.

Furthermore, the MPR threshold for SINT and LINT was determined using the threshold regression model to be 11 and 13 percent, respectively. According to the model's results, MPR has a bigger impact on SINT and LINT when it is above the anticipated threshold than when it is below it. The findings suggest that price stickiness is below the threshold, with the degree of stickiness varying depending on the SINT or LINT market interest rate being studied. Additionally, the non-linear ARDL model's results demonstrate that, while the opposite effect also exists, rising MPR has a favorable impact on lending and short-term interest rates. The results show overall downward stickiness in pricing; theoretically, a fall in MPR should cause a decrease in SINT and LINT, but the amount of the decrease for LINT is small, and the effect for SINT is statistically negligible.

The monetary policy rate is becoming a more significant tool, especially in an economy that has seen an increase in the frequency of economic crises since the 2008 global financial crisis. The study's conclusions provide specific insights into the anticipated effects of changes in the policy rate and have significant implications for the use of monetary policy for either contractionary or expansionary goals. Furthermore, MPR's inefficiency as a tool for monetary policy is only true when it is changed downward. Reducing the policy rate is unlikely to impact other market rates; this is especially true below a certain threshold, perhaps 11 or 13 percent, depending on the particular interest rate market.

In order to increase the efficacy of monetary policy, we suggest that the monetary authorities concentrate on banking sector reforms that eliminate downward rigidities in the impact of MPR on market rates. This recommendation is based on our study's findings. A reform that could result in more competitive practices and more efficient financial institutions would be to expand the number of banks or decrease their size.

References

- Abdi, H., & Williams, L. J. (2010). Principal component analysis. *Wiley Interdisciplinary Reviews: Computational Statistics*, 2(4), 433-459.
- Aliyu, S. B., Saidu, S. A., Zubair, A. U., & Dawood, B. (2017). Effect of changes in Nigeria monetary policy rate on interest rates. *International Journal of Economics and Business Management*, 3(10), 9 28.
- Aydin, H. I. (2007) Interest rate pass-through in Turkey. *The Central Bank of the Republic of Turkey Research and Monetary Policy Department, Working Paper 5*.
- Berger, A. N., & Udell, G. F. (1992). Some evidence on the empirical significance of credit rationing. *Journal of Political Economy*, 100 (5), 1047-1077.
- Bernanke, B., Gertler, M., & Gilchrist, S. (1996). The financial accelerator and the flight to quality. *The Review of Economics and Statistics*, 1-15.
- Caporale, G. M., & Pittis, N. (2004). Robustness of the CUSUM and CUSUM-of-squares tests to serial correlation, endogeneity and lack of structural invariance: Some Monte Carlo evidence . *ReiheOkonomie / Economics Series, No. 157, Institute for Advanced Studies (IHS), Vienna*
- Central Bank of Nigeria (2020). Monetary Policy Committee Communique. No. 128.
- Central Bank of Nigeria (2019). Monetary Policy Committee Communique. No. 122.
- Central Bank of Nigeria (2016). Monetary Policy Committee Communique. No. 108.
- Central Bank of Nigeria (2014). Monetary Policy Committee Communique. No. 98.
- Central Bank of Nigeria (2007). Monetary Policy Committee Communique. No. 50.
- Central Bank of Nigeria (2006). Monetary Policy Committee Communique. No. 46.
- Egert, B., & Reininger, T. (2004). Interest rate pass-through in new EU member states: The case of the Czech Republic, Hungary and Poland. *William Davidson Institute Working Paper 671*.
- De Bondt, G. J. (2005). Interest rate pass-through: empirical results for the Euro area. *German Economic Review*, 6(1), 37-78.
- Dickey, D., & Fuller, W. A. (1979). Distribution of the estimators for time series regressions with a unit root. *Journal of the American Statistical Association*, 74 (366), 427-431.
- Dueker, M. J. (2000). Are prime rate changes asymmetric? *Review-Federal Reserve Bank of Saint Louis*, 82(5), 33-40.
- Egert, B., Crespo-Cuaresma, J., & Reininger, T. (2007). Interest rate pass-through in central and Eastern Europe: Reborn from ashes merely to pass away? *Journal of Policy Modeling*, 29(2), 209 225.
- Egert, B., & MacDonald, R. (2009). Monetary transmission mechanism in Central and Eastern Europe: Surveying the surveyable. *Journal of Economic Surveys*, 23(2), 277- 327.
- Fried, J., & Howitt, P. (1980). Credit rationing and implicit contract theory. *Journal of Money*,

Credit and Banking, 12 (3), 471-487.

Grigoli, F., & Mota, J. M. (2017). Interest rate pass-through in the Dominican Republic. *Latin American Economic Review*, 26 (1), 1-25.

Gryniv, I. (2007). Interest rate pass-through in Ukraine. *Doctoral dissertation, Economics Education and Research Consortium*.

Hannan, T., & Berger, A. (1991). The rigidity of prices: Evidence from the banking sector. *American Economic Review*, 81, 938-945.

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics*, 93(2), 345-368.

Itaman, R. E., & Awopegba, O. E. (2021). Finance, oil rent and premature deindustrialisation in Nigeria. *Structural Change and Economic Dynamics*, 59, 149-161.

Kelilume, I. (2014). Effects of the monetary policy rate on interest rates in Nigeria. *The International Journal of Business and Finance Research*, 8(1), 45-55.

Klein, Michael A. (1971). A theory of the banking firm. *Journal of Money, Credit, and Banking*. 3(3), 205-218

Koop, G., & Potter, S. M. (1999). Dynamic asymmetries in US unemployment. *Journal of Business & Economic Statistics*, 17(3), 298-312.

Kovanen Arto (2011). Monetary policy transmission in Ghana: Does the interest rate channel work? *International Monetary Fund Working paper* 275.

Levine, P., & Loeb, P. D. (1989). Asymmetric behavior of the prime rate of interest. *The American Economist*, 33 (2), 34-38.

Lowe, P., & Rohling, T. (1992). Loan rate riskiness: Theory and evidence, Research Discussion Paper. Reserve Bank of Australia, Sydney

Marotta, G. (2009). Structural breaks in the lending interest rate pass-through and the euro. *Economic Modelling*, 26 (1), 191-205.

Mishkin, F. S. (1996). *The channels of monetary transmission: lessons for monetary policy* (No.w5464). National Bureau of Economic Research.

Monti, M. (1971). A theoretical model of bank behaviour and its implications for monetary policy. *L'Industria*, 2, 165-191

Mordi, C. N., Adebisi, M. A., & Omotosho, B. S. (2019). Modelling interest rates pass through in Nigeria: An error correction approach with asymmetric adjustments and structural breaks. *Contemporary Issues in the Nigerian Economy: A Book of Readings*.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

Rotemberg, J. J., & Saloner, G. (1987). The relative rigidity of monopoly pricing. *The American Economic Review*, 77(5) 917-926.

Samba, M. C., & Yan, Y. (2010). Interest rate pass-through in the Central African Economic and Monetary Community (CAEMC) area: Evidence from an ARDL analysis. *International*

Journal of Business and Management, 5(1), 31-41.

Sanusi, A. R. (2010, November). Interest rate pass-through and the efficiency of monetary policy in Nigeria: 2002-2010. In *National Conference on State of the Nigerian Economy*.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in honor of Peter Schmidt* (pp. 281-314). Springer, New York, NY.

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American economic review*, 71(3), 393-410.

Tai, P. N., Sek, S. K., & Har, W. M. (2012). Interest rate pass-through and monetary transmission in Asia. *International Journal of Economics and Finance*, 4(2), 163-174.

Tang, M. J., Puah, C. H., & Liew, V. S. (2015). The interest rate pass-through in Malaysia: An analysis on asymmetric adjustment. *International Journal of Economics & Management*, 9(2).

Tkacz, G. (2001). Endogenous thresholds and tests for asymmetry in US prime rate movements. *Economics Letters*, 73(2), 207-211.

Tule, M. K. (2014). Responsiveness of Nigeria's short-term interest rates to changes in the policy rate. *Economic and Financial Review*, 52(3), 7.

Ur Rehman, H. (2009). Interest rate pass-through and banking market integration in ASEAN: A cross country comparison. *Doctoral dissertation, University of Malaya*.

Weth, M. A. (2002). The pass-through from market interest rates to bank lending rates in Germany. *Deutsche Bundesbank, Economic Research Centre Discussion Paper*, (11/02).

Yildirim, D. (2012). Interest rate pass-through to Turkish lending rates: A threshold cointegration analysis. *Economic Research Center Working papers in Economics*, 12 (07).

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>)