MONETARY POLICY SHOCKS AND FINANCIAL PERFORMANCE OF LISTED DEPOSIT MONEY BANKS IN NIGERIA: A STATIC AND DYNAMIC APPROACH

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ABSTRACT

This study investigated the extent to which monetary policy shocks affect financial performance of listed deposit money banks in Nigeria using both the conventional (static) and dynamic single-equation panel data methods. The study proxied monetary policy shocks with monetary policy rate and interbank call rate, while financial performance was proxied by market value per share. The study involved 12 listed deposit money banks and cover the period from 2010 to 2021. Specifically, the empirical analysis was based on pooled regression, fixed effects and random effects methods; while the robust analysis was based on Differenced Generalized Method of Moment DGMM. The model selection was based on the Likelihood Ratio test and Hausman specification test. The study found that the specified model is consistent with random effects theory. Further, our analysis shows that market value per share is persistent and can be predicted on the basis of its own immediate history; and that while monetary policy rate has positive and significant impact on bank financial performance, interbank call rate has a positive but weak significant impact on bank financial performance. Our estimated DGMM model for the relationship between monetary policy shocks and bank performance has no specification problem, and hence our results are empirically valid. The theoretical and practical implications of these findings are discussed.
Keywords: DGMM, inflation, interbank call rate, monetary policy rate, panel data,

INTRODUCTION

Towards the end of 2019, countries around the globe were hit by the unexpected COVID-19 pandemic, which has negatively impacted the global economy. The International Monetary Fund (IMF) estimated that the world economy will fall by 3% in 2021 and considered the resultant recession as the worst since the Great Depression of the 1930s (Derbali et al., 2021). In response to these consequences, major economies implemented monetary policy measures to save their economy, thereby affecting the behaviors of financial institutions (Wei & Han, 2021).

The financial intermediation theory states that the effectiveness of monetary policy depends on its effects on bank behaviour. This is because banks play important roles in monetary policy transmission mechanism. Accordingly, Morris and Sellon (1995) contend that changes in bank lending practices or in the role that banks play in financial markets can alter the transmission mechanism and have important policy implications. However, the effect of the global financial crisis has further provoked more enquiry on the effectiveness of monetary policy in this regard (Berger & Bouwman, 2014).

Despite the significant influence of monetary policy on bank performance, few studies have examined this relationship (Bikker & Vervliet, 2018; Borio et al., 2017). Additionally, from both a theoretical and an empirical standpoint, little is known about how monetary policy shocks like inflation, affect banks' performance. Thus, this study tries to explore how bank performance responds to changes in monetary policy shocks in the context of rising inflation in the Nigerian economy.

Nigeria offers an appropriate case to investigate, due to the recent hike of the monetary policy rate by the CBN to 18.5%, as part of a consistent tightening monetary policy to control inflation that currently stood at about 21%. Expectedly, this would weaken people's propensity to borrow and spend, prompting bank customers to increase their deposits and potentially causing the stock market to record price depreciation. This came amid the Naira scarcity occasioned by the Naira redesigned policy by the Central Bank of Nigerian (CBN).

Understanding the link between monetary policy shocks and bank performance is important for evaluating the effectiveness of the monetary policy. While monetary policy is not, of course, the only influence on interest rate structure, it has a major impact on it. The link between monetary policy and bank performance has gained prominence, particularly, in developed economies following the Great Financial Crisis (Nguyen et al., 2022). However, the link between monetary policy shocks and bank performance is an under-researched area in less developed economies such as Nigeria.

Inoguchi (2013) examined impact of interbank market and stock market on bank performance in Malaysia from1996–2006. In Korea, the period 1994–2006 is analyzed for interbank and foreign currency borrowing and 1995–2006 for stock prices. In Thailand, the period 1992–2006 is analyzed for interbank and foreign currency borrowings and 1993–2006 for stock prices. In addition, for the period after the crisis, data were taken for a 7-year period (2000–2006). Employing panel data regression techniques, the study finds evidence that interbank market and stock market have significant positive impact on bank performance.

Also, Akomolafe et al. (2015) examine impact of monetary policy on commercial bank performance. Their panel data set consist 55 bank-year observation for 5 banks, and covered the period from 2003 to 2013. Using different panel estimation methods, their finding shows that monetary policy has a positive and largely significant impact on bank performance. Relatedly, Khan et al. (2016) using the panel data framework examine the relationship between bank competition and monetary policy shocks for 5 banks in 5 ASEAN countries. Utilizing the two-step panel dynamic GMM method, their empirical analysis covering the period from 1999 to 2014. They found evidence that bank competition has a positive influence on effect of monetary policy shocks on bank lending decisions.

Similarly, Lopez et al. (2020) examined negative nominal interest rate on bank performance for 5200 banks in 27 advanced European and Asian countries from 2010 to 2017 using a panel data framework. Their empirical evidence finds weak positive overall impact of negative nominal rates on bank profitability. Overall, their results suggest that banks fare reasonably well under negative nominal interest rates, compared to low positive rates. Borio et al. (2017) in their own study, which used panel data framework, examined effect of monetary policy on bank profitability. Their sample includes 109 large international banks headquartered in 14 major advanced economies for the period 1995–2012. They find that monetary policy has positive and significant effect on bank profitability.

Musah et al. (2018) examine effect of interest rate spread on profitability of commercial banks for 24 commercial banks in Ghana using panel data framework. While their panel dataset includes 265 bank-year observations from 24 commercial banks, their empirical analysis covers the period from 2003 to 2016. Using panel data regression method, they find that there is a positive and statistically significant association between interest rate spread and bank profitability. In other studies, Nguyen et al. (2020) investigated impact of monetary policy on bank performance and risk for 30 Vietnam commercial banks from the period of 2017Q1 to 2020Q4 covering the COVID-19 pandemic (starting from 2020Q1). Utilizing the dynamic two-step system generalized method of moments (S-GMM) estimator, the empirical result shows that monetary policy expansion has a positive and significant impact on bank performance. The study also indicates that Covid-19 pandemic has a significant effect on bank performance.

This study therefore, contribute to literature by providing empirical evidence of the relative impact of monetary policy shocks proxied by monetary policy rate and interbank call rate on banks performance proxied by market value per share, focusing on listed deposit money banks in Nigeria. The study employed dynamic panel data framework that incorporates unobserved bank-specific effects that reflects relative constant differences across banks such as organizational culture and philosophies, in order to avoid omitted variable bias since they affect the relationship of interest. Second, we allow for nonlinearities in the relationship between monetary policy and bank performance. Ignoring such nonlinearity or endogeneity when in fact, it is sizeable, constitutes endogeneity bias in the relationship of interest. This has so far been neglected in empirical works, especially in Nigeria, while it is intuitively appealing.

METHODOLOGY

The dataset employed in this study comprise 132 annual panel observations obtained from 12 listed deposit money banks (DMBs) from 2010 to 2021. The banks include First Bank, Standard IBTC, Sterling, UBN, Wema, Zenith, Fidelity, UBA, Access, FCMB, Ecobank and GTB. The data were collected from the annual reports and financial statements downloaded from the official websites of the individual banks. Consistent with previous studies, we transform the data into logarithms to allow for data interpretation in terms of percentage. The study consider two dimensions of monetary policy shocks: monetary policy rate and interbank call rate. However, we controlled for inflation. We define financial performance in terms of market value per share of individual banks included in the study. This definition is consistent with bank practices regarding monetary policy.

Table 1: Descriptive Statistics

Variables	$\bar{x}$	σ	CV	S	K	P-value (JB)
MVS	10.3272	10.2936	99.67	1.5508	5.0883	0.0000
MPR	11.7767	2.1591	18.33	-1.500	4.5888	0.0000
IBCR	11.8278	4.6718	39.50	0.5146	3.8280	0.0053
INFL	12.3596	3.1941	25.84	0.3576	2.1230	0.0214

Source: Eviews output based on research data

Table 1 shows the main distributive features of the variables. The market value per share MVS shows high coefficient of variation CV, while monetary policy rate MPR recorded the lowest coefficient of variation. The skewness and kurtosis coefficients show that the distribution may deviate from normal. This is evidence in the p-value of the Jarque-Bera statistic which shows that all the variables are significant. Hence, our model estimation and empirical analysis is based on the natural logarithm of the above variables.

To analyze the extent to which monetary policy shocks affect bank performance, we employ both conventional (static) and dynamic single-equation panel data methods. For conventional panel data framework, we consider pooled regression, fixed effects and random effects methods. These methods are employed because panel data literature suggests that they can be used to analyze relationship of interest while capturing the associated heterogeneity impacts of individual deposit money banks (Brooks, 2014).

However, their limitations lie in their inability to capture the endogeneity or simultaneity inherent in the relationship between monetary policy shocks and financial performance of deposit money banks. Hence, in order to capture this endogeneity, we employ the popular first difference Generalized Method Moments or D-GMM approach suggested by Arellano and Bond (1991). However, the D-GMM method uses instrumental variables to control the endogeneity problem, hence its strength lies in the quality of the instruments utilized.

The model for the study relationship, which is the impact of monetary policy shocks on market value, is specified in functional form as follows:

$$LMVS = (LMPR,\ LIBCR, LINFL) \quad (1)$$

Where:
LMVS = Log Market Value Per Share
LMPR = Log Monetary Policy Rate
LIBCR = Log Interbank Call Rate LINFL
= Log Inflation

We measure the impact of monetary policy on market value per share of deposit money banks through the following econometric equation. The econometric/empirical specifications (logarithmic form) of the above functional model, incorporating inflation (INFL) as control variable, is specified as follows:

$$LMVS_{it} = \beta_0 + \gamma_i + \beta_1 LMVS_{it-1} + \beta_2 LMPR_{it} + \beta_3 LIBCR_{it} + \beta_4 LINFL_{it} + \epsilon_{it} \quad (2)$$

The above regression model is dynamic as it incorporates persistence parameter of the dependent variable $\beta_1 LMVS_{it-1}$ in the model. Persistence is the extent to which a variable is positively related to its previous values. For this model, where ϵ_{it} represents the regression residuals or error disturbances, β_0 is the model intercept which can be interpreted as the average value of MVS when all other right-hand side variables are zero; γ_i is the cross-sectional heterogeneity parameter representing the unobserved bank-specific factors such as organizational leadership style, philosophy and culture, while β_2, and β_3 are the main regression coefficients, respectively capturing the effects of monetary policy rate and inter-bank call rate. Also, β_4 capture the effects of inflation in the model as a control variable. Besides, while other variables have both space and time indexed it, γ_i has only space index since they represent latent organizational factors, such as organizational culture that do not usually vary with time but largely remain constant at least over the sample period.

There are three competing methods of dealing with γ_i in the above specified model: namely, pooled regression, fixed effects regression, and random effects regression. While the pooled regression approach assumes a homogeneity of the cross-sectional entities and disregards the heterogeneity effect argument, which assumes that γ_i is not relevant in the market value per share model. While both fixed effects and random effects methods differ by recognizing the relevance of γ_i but treats it differently in the model. The fixed effects method treats γ_i as an important explanatory factor that also correlates with both MPR, IBCR and INFL, while the random effects method assumes that γ_i follows an error process, and hence has correlation with error term ϵ_{it}.

To determine which of these methods follows our data-generating process, we utilize the two commonly used specification tests: namely, Likelihood Ratio and Hausman tests. The likelihood ratio test compares the pooled regression results and fixed effects results and is employed under the hypothesis that γ_i is significantly different from zero. Therefore, the significance of this test implies rejecting the pooled regression method. While the Hausman specification test compares the fixed effects results and random effects results and is employed under the null hypothesis that γ_i do not correlated with MPR, IBCR and INFL. It follows that the significance of this test would suggest the rejection of the random effects method in favour of the fixed effects method. This implies that, if both tests are significant, then there is empirical evidence that γ_i affects market value per share both directly and through its interaction with the included monetary policy variables.

EMPIRICAL ANALYSIS

In our empirical model, we specify market value per share to depend on monetary policy rate and interbank call rate, with inflation rate incorporated as control variable. Our objective is to determine the extent to which the observed variations in market value per share of money deposit banks are empirically linked to changes in monetary policy variables, after controlling for the effects of inflation in the model. Panel A contains the main regression results or the coefficient estimates, while Panel B contains the goodness of fit statistics. More specifically, we estimate the specified market value per share model, and the results are displayed in Table 2, with Columns 2, 3, and 4 containing the results for the pooled regression, fixed effects, and random effects methods respectively. Furthermore, the estimated unobserved company-specific effects (cross-sectional heterogeneity) and model specification tests (Likelihood Ratio and Hausman tests) are presented in Table 3, while the residual diagnostic plots are shown in Fig. 2 – 4.

Table 2: Estimation Results; LMVS = f(LMVS(-1), LMR, IBCR, LINFL) P-values in Parenthesis

1 Variable/Coefficient	2 Pooled Regression	3 Fixed Effect	4 Random Effect
Panel A: Main Regression results			
Constant (β_0)	-3.3429*** (0.0000)	-1.1212 (0.1245)	-3.3429*** (0.0000)
LMVS(-1)	0.9668*** (0.0000)	0.4031*** (0.0000)	0.9669*** (0.0000)
LMPR (β_1)	1.0728*** (0.0004)	0.9598*** (0.0002)	1.0728*** (0.0000)
LIBCR (β_2)	0.1826* (0.0656)	0.0242 (0.7812)	0.1826** (0.0323)
LINFL (β_3)	0.1068 (0.4092)	-0.1121(0.3298)	0.1068 (0.3363)
Panel B: Goodness of Fit and Model Diagnostic Tests			
R^2	0.8895	0.9264	0.8895
$\bar{R}^2$	0.8860	0.9168	0.8860
F-ratio	255.5494***(0.0000)	96.3255***(0.0000)	255.54***(0.0000)
DW-Statistic	2.0330	1.6180	2.0330
Panel C: Model Specification Tests			
LR Statistic	52.3756*** (0.0000)		
Hausman Statistic	0.0000 (1.0000)		

*indicates significance at 10% level
**indicates significance as 5% level
***indicates significance as 1% level
Source: EViews Output Based on Research Data

For Table 2, we can see that in Panel A, both the pooled regression and random effects methods produce similar results, in terms of the size, signs and significance for all the estimated coefficients, while the picture is different for the fixed effects method. More specifically, we can see that the intercept term ($\beta_0 > 0, p\text{-}value < 0.01,\ 0.05, 0.1$) is negative but highly statistical significance for pooled regression and random effect estimation methods, suggesting that market value per share would, on average, be significantly different from zero in the absence of all explanatory variables. However, while the fixed effect estimation shows that intercept term ($\beta_0 < 0, p\text{-}value > 0.01,\ 0.05, 0.1$) is negative but not statistically significant, suggesting that market value would on average, not be significantly different from zero in the absence of all the explanatory variables.

Also, β_1, which captures the effect of lagged market value per share on current market value per share, is consistently positive and has a zero p-value, indicating that market value per share is a significant function of its immediate past value. An increase in market value per share in the current year would trigger an increase in market value per share one year after. Therefore, for deposit money banks, market value per share is persistent and can be predicted based on its own immediate past performance.

Further, for the control variable, inflation, we can see that β_4 is positively signed for both pooled regression and random effect methods, indicating that higher inflation tends to be associated with higher market value per share. However, it is negatively signed for the fixed effect method, indicating that lower inflation tends to be associated with higher market value per share. While this coefficient is statistically insignificant for the fixed effect method (p-value = 0.3298), and for both the pooled regression (p-value = 0.4092) and the random effects method (p-value = 0.3363).

Focusing on the main relationships of interest, we can see that the coefficients capturing the effects of monetary policy produce similar signs for different estimation methods, with both β_2 and β_3 having a positive sign. This shows that market value per share is positively related to both monetary policy rate and interbank call rate. However, the p-values show that β_2 is statistically significant for the pooled regression (p-value = 0.0004), fixed effects (p-value = 0.0002) and the random effects methods (p-value = 0.0000), they are statistically significant at 1% levels for all methods; while the p-values show that β_3 is statistically significant for both the pooled regression method (p-value = 0.0656) and the random effect method (p-value = 0.0323), at 10% and 5% levels respectively. However, the fixed effect method shows that β_3 is statistically insignificant. Hence, the conclusion that would be drawn from these results would depend on which of the estimation methods is valid in the context of our data.

For the model diagnostics, the F-statistic (p-value = 0.0000) in Panel B has a zero p-value in all cases, and therefore shows that the fitted market value model is highly significant. However, it is not clear which method produces the most plausible results for the relationships under investigation. As indicated by the $\bar{R}^2$, the proportion of the model variation explained by the joint influence of all included variables is about 91% for the fixed effects method and almost 89% for both the pooled regression method and the random effects method. This shows that the fixed effects method performs better than both pooled regression and the random effects methods. However, the Durbin-Watson statistic indicates that the pooled regression and random effects methods (DW = 2.0330) outperforms the fixed effects method (DW = 1.6180). Finally, in terms of the residual diagnostic plots shown in Figures 2 - 4, the three estimations, in all cases, perform equally well with the actual line being very close to the fitted line for all methods. However, our conclusion on which method to prefer would depend on the outcome of the model specification tests.

For the model specification test, in Panel C, we can see that the Likelihood Ratio (LR) statistic (p- value = 0.0000) is highly significant, and hence, rejects the pooled regression assumption that the unobserved variables are not significant explanatory factors for the observed cross-sectional variations in firm market value per share. Differently, the Hausman test statistic (p-value = 1.0000) is insignificant, and thereby could not reject the random effects assumption that there is a zero correlation between the unobserved bank specific effects and the observed explanatory variables. Therefore, there is sufficient empirical evidence that for deposit money banks, the relationship between monetary policy and market value per share is consistent with the random effects theory. This suggests that our data-generating process is consistent with the random effects method, hence, going forward, our empirical estimation analysis and conclusion shall be based on the random effects results.

Table 3: DGMM Results for the Model (DV = LMVS)

1 **Variables/Coefficients**	**2** **Estimates**	**3** **P-value**
Panel A: Main Regression Results		
LMVS(-1) (θ_1)	1.7166	0.4994
LMPR (θ_2)	3.9376	0.7247
LIBCR (θ_3)	0.3010	0.5485
LINFL (θ_4)	3.1799	0.5574
Panel B: Goodness of Fit and Model Diagnostic Tests		
Instrument Rank	6	–
Endogenous Variables	5	–
J-statistic	0.1795	0.9142
AR(1)	-0.6403	0.9966
AR(2)	0.0575	0.9986

Source: EViews Output Based on Research Data

From Panel B of Table 3, we can see that the instrument rank or the number of instruments (m =6) is greater than the number of endogenous variables (g = 5), indicating that the specified DGMM model for the relationship between monetary policy shocks and bank financial performance is overidentified. However, the J-statistic (p-value = 0.9142) is estimated with a high probability, and hence, fails to reject the hypothesis that the overidentifying restrictions are valid. Also, as expected, the second order serial correlation statistic (AR(2) = 0.0575, p-value = 0.9986) is not significant, while the first order statistic (AR(1) = -0.6403, p-value = 0.9966) has a negative sign, although not statistically significant. Further, the residual diagnostic plot in Figure 5 shows that the actual line is very close to the fitted line while the residuals are stationary. Therefore, the diagnostic test results suggest that the estimated DGMM model for the relationship between monetary policy shocks and bank performance has no specification problem, and hence its results are empirically valid.

From Panel A of Table 3, we can see that the coefficient on LMVS(-1) (θ_1 = 1.7166, p-value = 0.4994) is positive but not statistically significant, indicating that lagged market value is not significant determinant of market value. This implies that the relationship between monetary policy shocks and bank performance has no long memory or dynamic effect, and hence can largely be described by a static process with no feedback effect. In terms of the performance of the monetary policy shock variables in the GMM framework, the results provide some interesting insights, especially when compared with the results earlier obtained from the conventional methods. First, the coefficient on LMPR (θ_2 = 3.9376, p-value = 0.7247) is estimated with a positive sign and a high p-value, hence, it is not statistically significant.

Comparing this with the preferred random effects results in Table 2, we can see that both the direction of the relationship between monetary policy rate and market value is sensitive to different methodologies, accordingly, the significance of this relationship also largely depends on the estimation method used. Secondly, the coefficient on LIBCR (θ_3 = 0.3010, p-value = 0.5485) has a positive sign and a high p-value indicating that the relationship between interbank call rate and market value is positive but not statistically significant. When compared with the random effects results in Table 2, there is evidence that the positive but insignificant relationship between interbank call rate and bank market value is sensitive to estimation methods. Finally, for the control variable, the coefficient on LINFL(θ_4 = 3.1799, p-value = 0.5574) has a positive sign and a high p-value indicating that the relationship between inflation rate and market value is positive but not statistically significant. When compared with the random effects results in Table 2, we can see that the relationship between inflation and bank market value is largely not sensitive to different estimation methods.

DISCUSSION AND CONCLUSION

This study investigates the extent to which monetary policy shocks affects financial performance of listed deposit money banks in Nigeria using both the conventional (static) and the dynamic single-equation panel data methods. Specifically, the empirical analysis is based on the three conventional panel data methods: namely, pooled regression, fixed effects and random effects methods, while the robust analysis is based on Differenced Generalized Method of Moment of DGMM. The model selection is based on initially, the Likelihood Ratio test and finally, Hausman specification test. Base on the outcome of the Hausman test statistic presented in Table 2, we find no sufficient evidence to reject the random effects null hypothesis, hence we proceed with the random effects estimation result as the most preferred. The findings are summarized as follows: Consistent with the random effects theory, our empirical analysis shows strong evidence that bank heterogeneity, which is treated as an error process is an important aspect of the dynamic relationship between monetary policy shocks and financial performance. This result is expected given that the companies in our sample operate in the same industry, however, respond to monetary policy shocks at different frequencies, and hence a model that incorporates company-specific effects as an error process is more appropriate to account for the observed variations in bank financial performance. The implication is that the unobserved company-specific (organizational culture, leadership, and management style) are not part of explanatory factors for bank performance, but rather, part of the error terms.

There is evidence that monetary policy rate has a positive and significant impact on bank performance. This means that higher monetary policy, which implies contractionary monetary policy, is strongly associated with high bank performance. More specifically, a 1% increase in monetary policy rate would, on average, lead to about 1.07% increase in bank market value, holding other factors constant. This finding, which is consistent with the previous empirical works of Borio et al. (2017) implies that the market value of deposit money banks DMB marginally change upward following an increase in monetary policy rate by the CBN. This can be explained by the mechanism that, when monetary policy rate increases, the opportunity cost of holding money increases, making bank customers resort to deposits. Since bank deposits provide liquidity, higher interest rates allow banks to earn larger spreads on deposits. This increases the equilibrium spread between the nominal interest rate and the interest rate on deposits, thereby increasing banks' market value per share (Di Tella & Kurlat, 2017).

There is evidence that interbank call rate has a positive but weak significant impact on bank performance. This shows that higher interbank call rate is weakly associated with high bank performance. More specifically, a 1% increase in interbank call rate would, on average, lead to about 0.18% increase in bank market value per share, keeping other factors constant. This finding which is consistent with the previous work of Inoguchi (2013), indicates the tendency of the market value per share of deposit money banks to respond positively to risks associated with interbank lending rate. This behaviour can be explained by the high discipline among deposit money banks in terms of regulations.

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