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THE EFFECTIVENESS OF BANK CREDIT CHANNEL OF MONETARY POLICY TRANSMISSION: THE NIGERIAN EXPERIENCE

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Abstract

Using Structural Vector Autoregressive (SVAR) technique, the paper tested the effectiveness of bank credit channel of monetary transmission with the adoption of deregulatory measures in Nigeria. Secondary data obtained from the International Financial Statistics and Central Bank of Nigeria for the period 1986:1 to 2006: 4 were employed in the analysis of the responses of bank balance sheet variables to monetary policy shock. The study found that bank deposits, securities holdings and total loans and advances responded slowly to monetary policy shock during the simulation period. Monetary policy shock also contributed very little to the forecast errors of these bank balance sheet variables. The paper concludes that the bank credit channel is ineffective in Nigeria.

Introduction

In recent years the issue of the effectiveness of the bank credit channel of monetary policy transmission has attracted substantial research interest (Bernanke and Blinder (1992), Bernanke (1993), Romer and Romer (1990)). The bank credit channel of monetary policy transmission (a sub-channel of the credit view) holds that because of asymmetric information in the credit market, banks are able to play special role by providing loans to some categories of firms which under normal circumstance would have found it difficult to obtain finance from the capital market. This implies that monetary policy affecting the supply of bank credit adversely affect the investment behaviour and the performance of these firms.

The renewed interest in the role of bank credit for the transmission mechanism has been fueled by the wave of financial deregulation that has blown across several countries recently. Earlier studies which empirically tested for the existence of the bank credit channel in United States and some industrial countries have shown that this channel of

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monetary transmission exists. However it has been argued recently that financial deregulation has altered the structure of financial markets in a way that should have weakened this channel overtime (Thornton, 1994), (Bernanke and Gertler, 1995)). Two main reasons advanced by the proponents of the above view are: first, the deregulation of financial markets have subjected banks to stiff competition from non-bank intermediaries and this have opened up financial options for some firms who initially relied on banks for finance. This implies that the deregulation of financial markets have reduced the share of bank credit in total amount of funds available to the private sector (Edwards, 1993), (Gorton and Pennachi, 1993)). Second, it has been maintained that banks' access to financial markets has increased significantly, resulting in greater proportion of bank funds coming from sources that are not affected directly by the central bank action. Under these conditions proponents of the above view stressed that banks are no longer special.

Though the above view is to a large extent tenable in industrialized countries, the lack of extensive studies on monetary transmission mechanism, continuous change in economic structure and substantial data problem such as shortness of time series and structural breaks have made studies on the role of bank credit in monetary transmission quite mixed in developing countries (Bank of Korea, 1998), Kim (1999), Carrasquilla (1998), Carcia (2001). Montiel (1991) also noted that the process of monetary policy transmission in developing countries has also been bisected by problems such as limited menu of financial assets to private agents, absence of organized markets for securities and securities to mention only few.

This paper investigates the effectiveness of the bank credit channel of monetary policy transmission by focusing on the Nigerian economy. The Nigerian case is particularly relevant for two main reasons. First, despite the adoption of financial liberalization program in 1987, available data reveal that some features prevalent under the regulated regime still persist. The banking sector which has been the dominant sector in the financial market before the adoption of deregulatory measures still leads. This sector remains the provider of the bulk of financial liabilities to the private sector of the economy and its activities also dominate that of non-bank financial intermediaries

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(Iniodu, and Udomesiest, 2004). These features, therefore, seems to lend credence to bank credit channel of monetary transmission. Second, though several studies have been conducted to test for the effectiveness of the bank credit channel of monetary policy transmission in developed countries, no known study, to our knowledge have empirically investigated the existence or otherwise of bank credit channel of monetary transmission in Nigeria.

The remaining aspect of this paper is organized into four sections. Section 2 focuses on the econometric framework and the model. In section 3 discusses the measurements and sources of data used in estimation. Section 4 focuses on the empirical results. The policy implication of the paper is considered in section 5.

Econometric Framework and the Model

To test for the effectiveness of the bank credit channel in Nigeria, this study, drawing from Bernanke and Blinder (1988, 1992) augmented the existing IS-LM framework by including bank portfolio of assets and liabilities and other variables in our model. Given that the dynamics of the economy could be typically approximated by a system of linear equations containing these variables, a Structural VAR (SVAR) model (assuming ρ lags but no exogenous variables) is specified as

$$A_0 y_t = A_1 y_{t-1} + ...A_k y_{t-k} + CD_t + Be_t \quad (1)$$

where $y_t = (y_{1t}, y_{2t}, \ldots y_{nt})'$ is an nx1 vector of non-policy and policy variables and the A_i and C are parameter matrices of order nxn. D_t contains all deterministic variables which may consist of a constant, a linear trend, seasonal dummy variables as well as other specified dummy variables. Moreover, e_t is an nx1 vector of structural shock or innovations in policy and non-policy variables are assumed to be a white noise process with $(0,1_n)$. The reduced-form of equation (1) which is estimated in the study is

$$y_t = \Gamma_0 + \Gamma_1 y_{t-1} + ...\Gamma_{t-\rho} + u_t \quad (2)$$

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where $\Gamma_i = A^{-1}A_i$ (i = 0, 1…..ρ) and the relationship between the reduced-form and SVAR residuals is given as

$$u_t = A^{-1}Be_t \quad \text{and} \quad Au_t = Be_t \tag{3}$$

Equation (3) above is called the AB model by Amisano and Giannini (1997). To identify the reduced-form VAR above, these authors imposed restrictions on the contemporaneous matrices A and B. When $B = I_n$, we have the **A**-Model and monetary policy shocks are identified by imposing restrictions on the contemporaneous relationship between the VAR residuals; that is, matrix A in the AB-Model. On the other hand, if $A = I_n$, we have the B-model and the identification scheme is recursive and $B = \Delta$, where $\Delta\Delta' = \Sigma$ and Δ is a lower triangular. A general case of AB-Model exists where restrictions is placed on both A and B matrices.

For the A and B-Models, at least n(n-1)/2 restrictions have to be imposed for identification of a system with n endogenous variables, for the AB model, at least $n^2+n(n+1)/2$ restrictions are needed (see Breitung, Bruggemann and Lutkepohl, 2004). In this study, the restrictions is imposed in the A matrix in the AB model while matrix B is assumed to be diagonal.

The vector of endogenous variables is defined as

$$y_t = (lcpi_t, lea_t \; lr_t, lsh_t, ltla_t \; lbtd_t \; ltbr_t \; lner_t)' \tag{4}$$

where

$lcpi_t$ = consumer price index(2000=100);

ea_t = economic activity (captured by $lrgdp_t$ or $lipi_t$);

$lrgdp_t$ = real gross domestic product

$lipi_t$ = industrial production(2000=100);

lr_t = average lending rate of banks;

lsh_t = securities holdings of banks;

$ltla_t$ = banks' total loans and advances;

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$lbtd_t$ = bank deposits;

$ltbr_t$ = treasury bill rate;

ner_t = nominal exchange rate(=N=/$).

In the model represented by equation (4) above, all variables are in their logarithmic form except the lending rate (lr) and the Treasury bill rate (tbr). To achieve identification in the SVAR, we adopt the non-recursive scheme. Being guided by Kim (1999) and Holtermoller (2002) and given that matrix B is diagonal and of order 8x8; matrix A has the following structure:

tbr	lbtd	lcpi	lrgdp	lsh	lr	ltla	lner
1	*	0	0	0	0	0	*
*	1	*	*	0	0	0	0
0	0	1	*	0	0	0	0
0	0	0	1	0	0	0	0
*	*	0	0	1	*	0	0
*	*	0	0	0	1	*	0
0	0	*	*	0	*	1	0
*	*	*	*	*	*	*	1

The identification scheme above is over-identified with six restrictions and the asterisks (*) symbolizes freely estimated parameters. The first line represents monetary policy rule or the reaction function of the central bank. The second line, which is banks' total deposits or quasi-money equation, proxies the standard money demand equation; with real GDP and the Treasury bill rate as the scale and opportunity variables respectively. The hypothesis of price stickiness is incorporated in the third and forth lines of the scheme. The banking sector's behaviour, in terms of securities holdings is represented by line five. Banks' securities holdings depend on the Treasury bill rate and the lending rate. Line six and seven depict loans supply and demand respectively, while the last line is the arbitrage equation. It is important to note that in the recursive identification schemes, the nominal exchange rate reacts immediately to the monetary shock.

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The necessary conditions that must prevail for the bank credit channel to exist following Bernanke and Blinder (1992) include (i) the bank deposits as well as securities fall immediately in response to monetary shock; (ii) total bank credit declines but only after a lag of two three quarters; (iii) banks are able to maintain lending in the face of decline in deposit by selling securities; and (iv) the eventual decline in bank lending corresponds in timing with a decline in economic activity. As additional condition, Friedman and Kuttner (1993), Suzuki (2001) and Holtermoller (2002) also argued that the price of credit should rise while quantity of credit should decline under monetary tightening.

Data Measurement and Sources

Quarterly time-series data from 1986:1 to 2006:4 were utilized in estimating the SVAR model. Variables can be categorized into policy variables, non-policy variables or bank balance sheet variables. The monetary policy variables used in the study is the Treasury bill rate which is a short time interest rate. The innovation to this variable in the SVAR is interpreted as the unanticipated monetary policy shock. The Treasury bill rate series were obtained from the Central Bank of Nigeria Statistical Bulletin (various issue). Economic activity is proxied by real GDP or industrial production. The real GDP is measured as nominal GDP deflated by consumer price index (2000 =100). The real GDP and index of industrial production series were obtained from International Financial Statistics (IFS). In the absence of quarter GDP series, the Annual series were decomposed into quarterly series using the Galdalfo's (1981) algorithm. The general price level is measured by the composite consumer price index (2000=100). The composite consumer price index was also obtained from the IFS. Bank balance sheet variables include total bank deposits, bank securities holdings and loans and advances. Total bank deposit is measured as the total deposits with deposit money banks, while bank securities holding is the sum of investments of deposit money banks in treasury bills, treasury certificates and other securities. With respect to bank credit, this is measured as total loans and advances of deposit money banks. The bank balance sheet data are sourced from IFS and the CBN Statistical Bulletin. The lending rate of bank is

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obtained by taking the average of the prime lending rate and maximum lending rates of banks. This series is also obtained from the CBN Statistical Bulletin.

Estimation Technique and Empirical of Analysis

Estimation Technique

To estimate our model data were initially subjected to unit root test using both the Augmented Dickey Fuller (ADF) and the Philips-Perron procedures. To determine the order of the reduced-form VAR, the Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn Criterion (HQ) were adopted. Since all variables were found to be I(1) series a cointegration test was done using the multivariate approach proposed by Johansen (1988) and Johansen and Juselius (1990).

Given the existence of 4 cointegrating vectors as obtained from the trace statistics, the conventional approach is to estimate a Structural Vector Error Correction Model (SVECM). However to avoid the problem of misspecification which could arise due to incorrect imposition of long-run identifying restrictions coupled with the need for imposition of short run restriction to achieve identification, a different procedure was pursued in this study. Following Benkwitz et. al. (2001), the reduced-form VAR in levels was consistently estimated and appropriate confidence intervals for the impulse responses were obtained using Bootstrap procedure. This procedure involves three steps: first, the estimated coefficients and the fitted residuals from the estimated model were initially saved. Second, the residuals were reshuffled with replacement, and in the last step, an artificial data set were created using the estimated VAR model as the true data generating process. In the study, a series of 1000 of such simulations were undertaken.

In the analysis, impulse response functions (IRFs) and forecast error variance decomposition (FEVD) were used. The IRFs trace out the response of current and future values of each of the variables to a one-unit increase in the current value of one of the VAR errors, assuming that the errors are equal to zero. The FEVD, on the other hand is the percentage of the variance of the error made in forecasting a variable due to a specific shock at a given horizon. All the variables entered the reduced-form VAR model in their logarithmic form except the treasury bill rate (tbr) and average lending rate of banks (lr).

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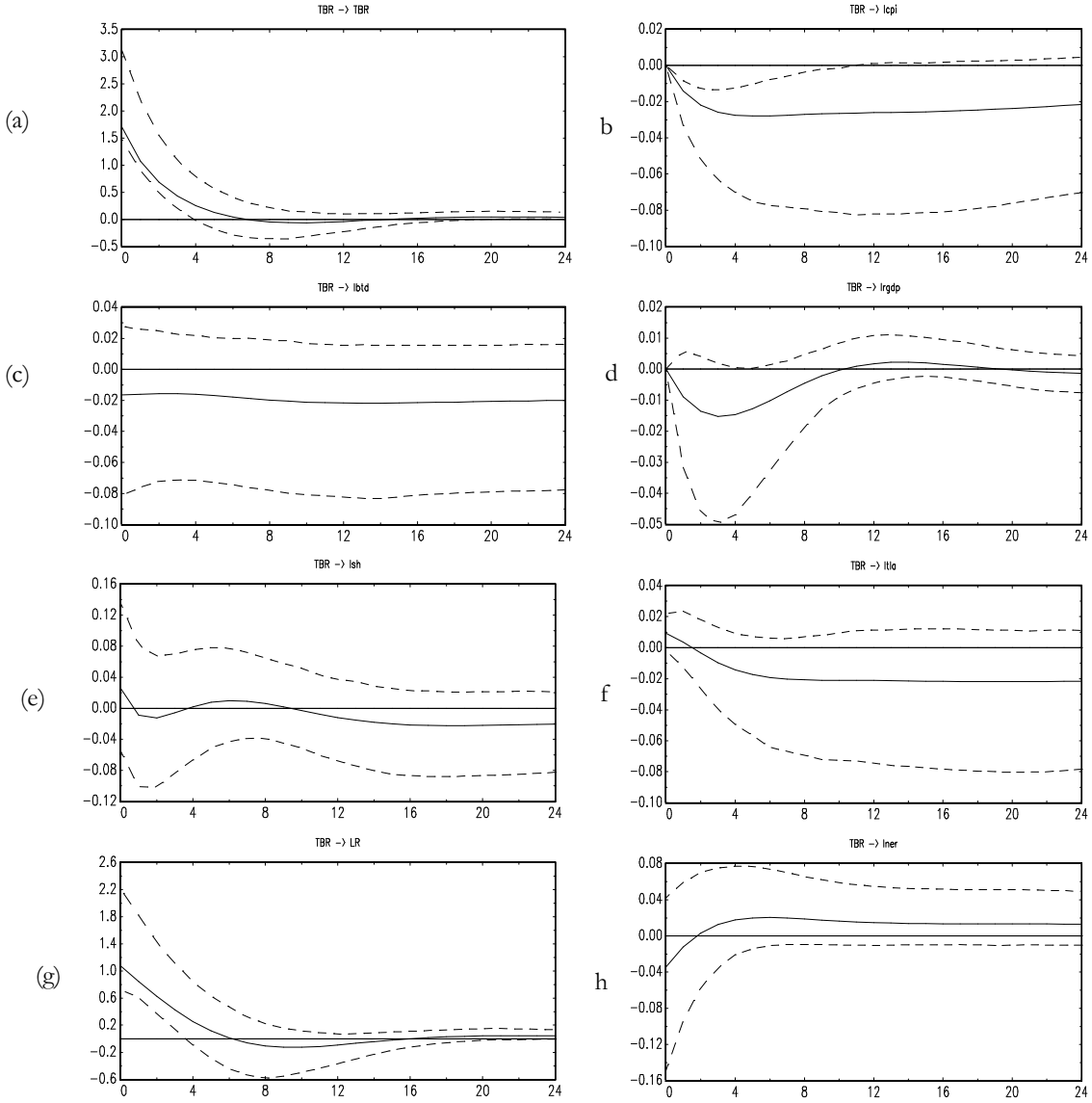
Figure 1: Impulse response functions of SVAR Model (Non-Recursive Identification Restrictions)



Note: Solid lines indicate SVAR impulse response while broken lines indicate 95% Hall's Percentile confidence intervals calculated with 1000 Bootstrap procedure. Author's Calculation

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Empirical of Analysis

Impulse response analysis

In testing for the existence of bank credit channel, there is the need to examine how banks adjust their portfolio in response to monetary policy shock. Banks' assets are captured by bank securities holdings (lsh) and total loans and advances (ltla). The only banks' liability included in the study is total deposits (lbtd).

Using the non-recursive identification scheme, the response of non-policy variables as well as bank portfolio to policy variable are indicated by the impulse response functions (IRFs) in Figure 1. Panel (a) shows that a one standard deviation in treasury bill rate is estimated as approximately 1.7% unanticipated increase in this variable. This shock from treasury bill rate can be interpreted as unanticipated monetary policy shock. With the unanticipated hike in treasury bill rate (tbr), the impulse response function in panel (c) shows that bank deposits declined immediately by approximately 2% and the maximum impact of monetary policy occurs when this variable decline by about 2.2% after 13 quarters. The insignificant impact of monetary policy on bank deposit could be attributed to the adoption of liability management in Nigerian banks. Panel (e) also indicates that bank securities holding, following the hike in treasury bill rate immediately rises by 2% declined by only 0.9% and 1.2% after the first and second quarters respectively and a positive innovation is recorded afterwards. With respect to bank credit, the point estimates of the IRF in panel (f) further indicates that this variable initially rises by 1% and decline by approximately 0.4 after the second quarter and the maximum impact of the hike in treasury bill rate occurs when this variable decline by 2.2% after the 19^{th} quarter.

To examine the impact of monetary policy on economic activity and prices, the IRF in panel (b) shows that the unanticipated monetary policy shock measured as the hike in treasury bill rate produces negative innovation in consumer prices. Prices decline by approximately 2.4% after the 5^{th} quarter and this is in line with theoretical expectation. This corroborates the Fisher's quantity theory of money; the hike in treasury bill rate leads to a fall in bank deposits (a component of money supply) and ultimately leads to a fall in prices. IRF in panel (d) further indicates that real GDP(Lrgdp) falls immediately

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following an unanticipated hike in treasury bill rate, with a maximum impact of 1.3% decline occurring after 3 quarters.

Since one of the basic objectives of monetary policy is to ensure exchange rate stability, we also examine the behaviour of this variable to shock in treasury bill rate. The IRF in panel (h) above indicates that nominal exchange rate (panel h) initially depreciates only to appreciate later. The initial depreciation in exchange rate following monetary policy shock contradicts theoretical expectation as a rise in domestic interest rate is expected to lead to the appreciation of nominal exchange rate. This result is not surprising since this problem has been identified as the *exchange rate puzzle* in the literature. The existence of this puzzle could be ascribed to round-tripping of foreign exchange by Nigerian banks. Round tripping as a term refers to a financial malpractice in which banks obtain supply of foreign exchange from the Central Bank at the official rate and resell the same in parallel market at higher rate.

Another crucial aspect of the analysis is the investigation of the impact of monetary policy on the average lending rate (lr) of banks. As the IRF in panel (g) shows, the shock in treasury bill rate initially leads to a 10 percent point increase in the average lending rate (lr) of banks within the simulation period.

The results of SVAR model have shown that bank deposits declined negligibly following the hike in treasury bill rate. Bank securities holdings, though fell later, immediately rises after the hike in treasury bill rate. There was an initial increase in bank credit after monetary policy shock; this was followed by a permanent negative shock to this variable.

A question that arises at this juncture is: to what extent did the above findings fit the scenario where the bank credit channel is operative? The evidence draw from the IRFs indicates that the responses of bank portfolio of assets and liabilities to monetary policy shock are either very negligible or contrary to theoretical expectation. The fact that the average lending rate (figure 1g) of banks increased immediately following tight monetary policy coupled with the initial rise in bank credit following monetary policy shock indicates that the bank credit channel is very weak in the Nigerian economy. The robustness of the above findings was also investigated by estimating a SVAR model with

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real values of bank assets and liabilities. Though not presented in this study, the results unambiguously reinforced earlier findings. The inability of monetary policy to have a strong impact on bank lending could be attributed to the excess liquidity in the banking system during this period. Moreover, the adoption of liability management in Nigerian banks could also be another crucial factor. In support of the above view, Ojo(1992) observed that in the 1980s and 1990s aggregate bank credit consistently exceeded its targeted level. The results of the impulse response analysis also suggest that monetary policy affect prices than real activity in Nigeria.

Forecast error variance decomposition (FEVD)

To shed more light on the findings under the IRFs, this section tests the importance of the bank credit channel in the light of the recent deregulation of the financial markets in Nigeria. In analyzing the FEVD, results are reported for forecast horizons of 1, 4, 12, and 24 quarters. Since the contributions of shocks in treasury bill rate(a measure of monetary policy) is the most important, Table 1 indicates that this shock contributes only 5% and 6% to forecast error variance(FEV) in bank deposits after the 4th and 12th quarter. Shock in treasury bill also contributes 1% and 0% to the FEV in bank securities holdings after 4th and 12th quarters respectively, while it only accounted for 1% and 7% of the FEV in bank credit. Monetary policy shock also accounted for 35% of variation in the average lending rate of banks after the 1st quarter but its contribution declined to 18% and 17% after the 12th and 24th quarters. These results corroborate the results obtained using IRFs as analytical tool and clearly show that the bank credit channel is weak in Nigeria.

With respect to economic activity and prices, monetary policy shock contributes 4% and 5% to the FEV in real GDP after the 4th and 12th quarters respectively, while it accounted for 11% and 12% of the FEV of consumer prices within the same forecast horizon. This indicates that monetary policy affects prices than real output in the Nigerian economy. While monetary policy has little impact on real GDP, the FEVD indicates that shock in nominal exchange rate is the dominant factor which contributes 20% and 27% to this variable. This evidence underscores the role of foreign exchange in the Nigerian

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economy. Given a monocultural economy where the bulk of domestic resources emanate from oil exports, this result is not at all surprising.

Overall, the results under the FEVD have reinforced that obtained under the IRFs. It clearly indicated that the bank credit channel of monetary transmission is not important during the study period characterized by financial deregulation and innovation. The study also suggests that monetary policy exerts more influence on prices than real activity. Moreover the dominant factor contributing to the variation in real GDP is the nominal exchange rate.

Table 1(a) SVAR Forecast Error Variance Decomposition

Forecast horizon (quarters)	tbr	lbtd	lcpi	lrgdp	lsh	lr	ltla	lner
	Proportion of forecast error variance in tbr accounted for by:							
1	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00
4	0.53	0.12	0.00	0.02	0.21	0.1	0.01	0.01
12	0.38	0.11	0.01	0.07	0.23	0.15	0.01	0.05
24	0.36	0.11	0.02	0.07	0.22	0.14	0.03	0.05
	Proportion of forecast error variance in lbtd accounted for by:							
	tbr	lbtd	lcpi	lrgdp	lsh	lr	ltla	lner
1	0.05	0.91	0.03	0.01	0.00	0.00	0.00	0.00
4	0.05	0.88	0.02	0.03	0.01	0.00	0.00	0.01
12	0.06	0.78	0.01	0.06	0.02	0.00	0.01	0.06
24	0.07	0.72	0.00	0.06	0.02	0.00	0.03	0.10
	Proportion of forecast error variance in lcpi accounted for by:							
	tbr	lbtd	lcpi	lrgdp	lsh	lr	ltla	lner
1	0.00	0.00	0.85	0.15	0.00	0.00	0.00	0.00
4	0.11	0.06	0.52	0.12	0.02	0.01	0.16	0.00
12	0.12	0.15	0.30	0.05	0.04	0.02	0.30	0.01
24	0.11	0.21	0.22	0.02	0.06	0.01	0.31	0.04
	Proportion of forecast error variance in lrgdp accounted for by:							
	tbr	lbtd	lcpi	lrgdp	lsh	lr	ltla	lner
1	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
4	0.04	0.01	0.00	0.73	0.01	0.02	0.00	0.20
12	0.05	0.05	0.02	0.49	0.06	0.02	0.03	0.27
24	0.04	0.09	0.05	0.45	0.06	0.01	0.05	0.25

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Policy Implications and Conclusion

Three main policy implications emerged from this study. First, the ineffectiveness of the bank credit channel presupposes that monetary policy has little or no effect on bank lending in Nigeria. This means that when the Central Bank of Nigeria engaged in monetary tightening banks do not find it prohibitively costly to expand loan supply. The main explanation for this is that Nigerian banking industry is characterized by excess liquidity. Another reason why banks could expand credit during monetary tightening is the wide adoption of liability management in the Nigerian banking industry recently. By managing the liability side of their balance sheet, banks no longer need to depend on demand deposit as a primary source of bank funds and can target their assets growth by issuing liabilities as the need be. Second, since the bank credit channel is weak and ineffective in Nigeria, it implies that the Central Bank of Nigeria cannot affect the real spending of borrower directly through this channel. The effectiveness of monetary policy as a stabilization tool therefore depends on other channels of monetary transmission. Last, the study also implies that macroeconomic policy formulation based exclusively on the credit channel as a transmission channel of monetary policy will be largely inadequate. This connotes that a search for more informative variable other than bank credit is essential for appropriate monetary management.

In conclusion, this study has found that though Nigeria is a bank-dominated economy, the bank credit channel is very weak and ineffective channel of monetary transmission under the period of financial deregulation.

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