Monetary Policy Pass-Through in Nigeria: An ARDL Bound Testing Approach

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Abstract

The paper investigates on the lingering issue of monetary policy transmission from the perspective of Nigeria from 1980 to 2016. Applying a two way techniques of Vector Autoregression and Autoregressive Distributed Lag, we found that (1) jointly considered, monetary policy does not have any long run relationship with economic activity. (2) credit transmission channel is ineffectual in monetary policy transmission in Nigeria. (3) money supply, interest rate and the exchange rate channels are positive channels of monetary policy transmission in Nigeria. Key policy recommendations were monetary policy approach that is more fiscal in nature and instrument specific policies for economic specific issues to grow the country above recessionary growth trajectory.

Resumen

El documento investiga sobre el tema persistente de la transmisión de la política monetaria desde la perspectiva de Nigeria desde 1980 hasta 2016. Aplicando una técnica bidireccional de autorregresión vectorial y desfase autoregresivo distribuido, encontramos que (1) considerada conjuntamente, la política monetaria no tiene ningún largo corre relación con la actividad económica. (2) el canal de transmisión de crédito es ineficaz en la transmisión de la política monetaria en Nigeria. (3) el suministro de dinero, la tasa de interés y los canales de la tasa de cambio son canales positivos de transmisión de la política monetaria en Nigeria. Las principales recomendaciones de política fueron un enfoque de política monetaria de naturaleza más fiscal y políticas específicas de instrumentos para cuestiones económicas específicas para hacer que el país crezca por encima de la trayectoria de crecimiento recesivo.

Key words: Monetary Policy, Economic activity, Transmission Channels, ARDL, Nigeria.

1.0 Introduction

Monetary policy is a deliberate action(s) from the government or her agency geared towards controlling monetary aggregates and other financial product in order to achieve price stability and macroeconomic growth. It is one of the important keys of macroeconomic management, the other being the fiscal policy key. When in use, monetary policy is a two side of the same coin. When the economy experience declining growth, expansionary monetary policy is expected to move the economy back to normal production growth path. However, when the economy's growth path is explosive such that inflation-induced growth is seen, a contractionary monetary policy help to bring down economic activities and prices. As Leahy (1993) noted, expansionary or contractionary policy have a substantial influence on the rate and pattern of economic growth by influencing the volume and disposition of saving as well as the volume and productivity of investment.

Be that as it may, economist differ as to the process of transmission of such monetary policy influences in an economy. While a majority argue of a direct channels of transmission of monetary policy to economic activities, others are of the opinion that such transmission is an indirect process. Worse still, there are argument that monetary policy transmission mechanism is different from region to region or country to country (see for instance, Kamin et al, 1998; Davoodi, Dixit and Pinter (2013); Samba, 2013). Thus, an effective monetary policy transmission channel(s) for an industrialized economy is expected to be different from that of an emerging economy and from that of a developing economy. Two factors make such argument plausible. The first is the different economic structures characterizing the different economies. With these different structures, needs and approaches will surely differ. The second reason is that all economies are in a global community and as such, global changes through technology, trade and investment continues to adjust each community in the global system to new economic challenges. Thus, a policy stance that were once plausible at one time may not be effective at other times. Faced with this dilemma, an understanding of the transmission process is essential to the appropriate design and implementation of monetary policy by concern academics and economist continually in their domain.

In response to this development, the Nigeria Central Bank (CBN) reviews events in the economy over a period of time to identify the risks associated with it and formulates monetary policies to mitigate such risk. For instance, from the 1980s when Nigeria felt sick to the Dutch disease and other economic crisis, the country has witnessed several policy changes with varying degree of effects on the level of economic activity. As part of its monetary policy contributions, the monetary authority has also been concentrating on fine-tuning monetary aggregates and other policy instruments depending on the level of structural development in the economy and especially the financial sector, in order to affect economic

activities. This resulted in the phase regime of monetary policy conduct before and after 1986. According to CBN, the first phase placed emphasis on direct monetary controls, while the second relies on market mechanisms.

The purpose of the paper is to contribute to the discussion of monetary policy pass through from the perspective of Nigeria. It attempts both to identify and review the transmission channels of monetary policy and to provide empirical evidence of the extent to which monetary policy has impacted on economic activities in the country. Given the present recessionary atmosphere in Nigeria, the study will be mainly concerned with how monetary policy pass through to prices and growth variables for macroeconomic stability and economic recovery. Nigeria has in recent times been passing through declining economic performance. In-fact the government in 2016 officially accepted passing through recession, with two quarters of declining output growth. It is theoretically sound, to investigate how monetary policy affected the economy prior to the recession.

Following this introduction, the rest of the paper is structured as follows: section 2 discusses the literature review on the subject; section 3 outline the method of study; section 4 analyze and present the results and section 5 concludes the paper.

2.0 Literature Review

2.1 Conceptual Issues

Almost all the schools of thought in the subject matter of economics agree that monetary policy is an important tool in economic management toolkit. They however differ in the degree of usage of the tool. For instance, the monetarist school of thought sees money supply as a direct channel in which monetary policy integrate the rest of the economy. Thus, any alteration in monetary volumes either positively or negatively is sure to influence the economy in the same direction as the alteration. The monetarist relied so much on the quantity theory of money postulation. If other variables in the theory are held constant, it could be shown that changes in money supply affect total output and prices in the same direction.

The Keynesian view of monetary policy are that while it plays a pivotal role in influencing the economy, such influence is rather indirect. The sensitivity of prices and economic activities to monetary policy changes are only noticed by fluctuations in the interest rate. Such influences are rather seasonal, for, according to them, monetary policy ability in permeating through the interest rate to the economy dies out in repressive or even depressive seasons. Thus, monetary policy is ineffectual in those seasons, in their opinion. In the case of the classicist school, the monetary policy effect on the economy is based on

the quantity theory of money which states that an increase or decrease in the quantity of money leads to a proportional increase or decrease in the price level while the real income, the rate of interest and the level of real economic activity remain unaffected (Bassey and Akpan, 2016). They thus see monetary policy as a weak phenomenon on the economy but can only be felt on the price level.

There are growing concern that at least four channels of monetary policy transmission in the literature. These are the interest rate channel, the exchange rate channel, the credit channel and the asset price channel. Other scholars have argued for the inclusion of such channels as the money supply, the inflation expectation, and the balance sheet channels in the list of monetary transmission (see for instance Gitonga, 2015). Figure 1 shows all the possible channels of monetary policy transmission in Nigeria. According to Figure 1, monetary policy permeates through the money market via the four channels earlier outlined to support the exchange interactions in the economy.

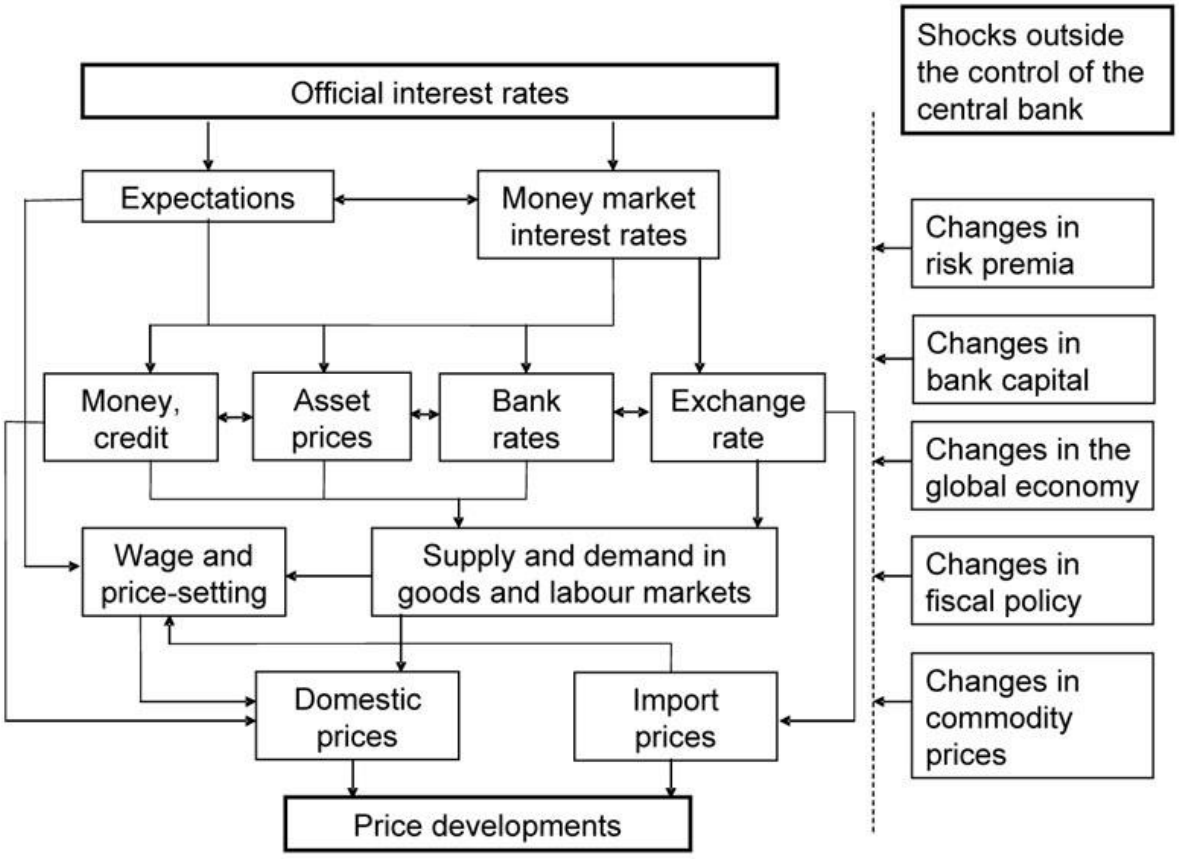

Figure 1.1: Monetary Policy Transmission Mechanism in Nigeria,
Source: Essien, et al (2016)

Figure 1 also shows that it is possible for shocks outside the country to move via the exchange rate channel to affect the economy. More than that, the activities of the labour market also form a conduit for monetary policy transmission through expectations to prices and the economy. Figure 2 shows how the various transmission channels affected the country in the period under review.

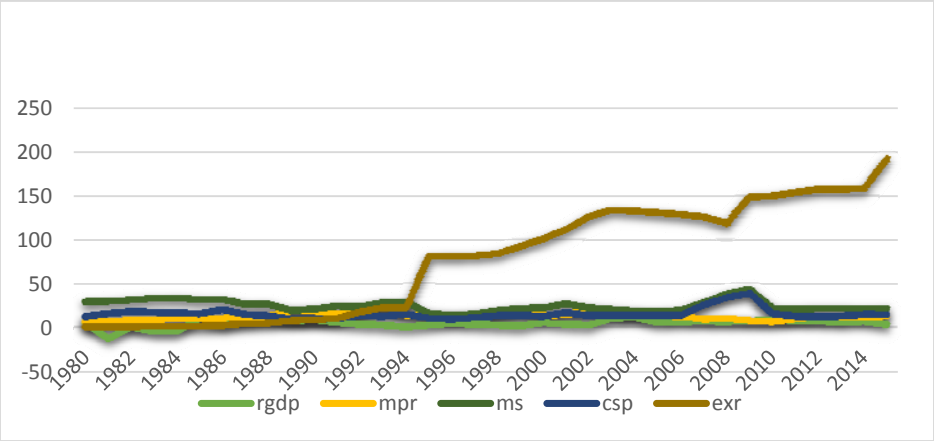

Figure 2: Performance of Monetary Policy and Prices in Nigeria 1980-2016
Expressed in growth rates

As can be glean from Figure 2, some of the transmission channels grew in tandem with economic activities for most of the early years under review (for instance movements in exchange rates, interest rates and the credit channels). Between 1980 and 1984, economic growth rate grew at a declining rate from 4 % to -5%. Thereafter, the growth rate took on positive value of 10% in 1985 and continued at a declining rate to 0% in 1994. Between 2003 and 2014, the highest growth rate was 11%in 2004 and the lowest growth rate was 5.4% in 2013. The policy rate also grew from 6% from 1980 to 18.5% in 1990. It however, fell from that point to 13.5% in 1997 before growing undulatingly to 15.75% in 2003 and felling to 12.2% in 2014. However, over time, some of the variables divers widely from economic activities for instance the exchange rates movement which took a sharp jump from 1994 to 2015. The credit supply growth moved from 12.2% in 1980 to 14.4% in 1987. It fell from there, taking on single digits to 9% in 1996. The credit supply growth was 13.5% in 1999 and maintained a steady growth to 25.2% in 2007. It further declined positively to 14.5% in 2014. However, the money supply channel, did not seem to indicate any interaction with economic activities from 1980 to 2016. It grew from 28.6% from 1980 to 33.02 % in 1984. It however decline from there to 23.24% in 1992. It further decline to 18.66% in 1998 before growing to 43.3% in 2009 and finally declining to 21% in 2015. Only empirical findings will reinforce which of the channels had noticeable influence on economic activities of the country over the period.

2.2 Empirical Literature Review

The literature is filled with studies of the inherent relationship between monetary policy and the general economy. In one such study, Ishioro (2013) examined the causality between monetary policy and the real economy in Nigeria in the periods 1970 to 2011. The three channels of monetary policy examined, the interest rate channel, the exchange rate channel and the credit channel were all found to be useful in linking the monetary sector to the real sector of the economy.

Tsangarides (2010) investigates the monetary policy transmission mechanism to output and prices in Mauritius in the period 1999 to 2009. Using Vector Autoregreesive technique (VAR), the study shows a rather weak monetary policy transmission channels for Mauritius. Money supply had a relatively small impact on output, although significant statistically. However, monetary policy had significant positive impact on prices in the economy and was persistent over some period.

Guerra, Rodriguez, and Sänchez (1998) investigated the impact of monetary policy on prices in Venezuela for the period 1985 to 1995. Applying VAR to first identify the pattern of response among the variables of interest and Error Correction Model to identify the direct and indirect relationship between prices and monetary policy on quarterly data, they found out that monetary policy transmits through M1 to prices in the economy, although the effect of such transmission was small but significant. Thus, an expansion of money stock (M1) in Venezuela induces an excess demand with high inflationary pressure in the economy.

Abdullahi (2014) examined the effect of monetary policy transmission on the Nigerian economy from 1980 to 2010 using Vector Autoregressive Technique (VAR) on the variables derived from the country. The study identifies three channels of monetary policy transmission mechanism for Nigeria, including the interest rate channel, the credit channel and the exchange rate channel. His results show that whereas credit and exchange rate channels were ineffective in transmitting monetary policy in Nigeria during the period, interest rate channel does. Citing intermediatory weaknesses in the failure of the other two channels as possible causes, the study recommends reduction in reserve deposit for banks as a boost to correct the failure. Similar results were also found for the Kenyan economy by Gitonga (2015). Their result is some-how different from that reported by Hung (2007). In his analysis of the Vietnam economy from 1996 to 2005 using seasonal quarterly data on vector autoregression (VAR) model and focusing on the reduced-form relationships between money, real output, price level, real interest rate, real exchange rate and credit, found evidence that monetary policy can affect output and price level. The results showed that the effect of monetary policy on output was strongest and manifested

earlier than its effect on the price level, pointing out that the significance of credit and exchange rate channels were strongest.

Adeoye, Ojapinwa and Odekunle (2014) decided to investigate only the credit channel of monetary policy transmission in Nigeria from 1986 to 2010 to see the effect of total credit supply to the general economy using VAR technique of analysis. Judging from their results, there exist a relationship between credit supply and aggregate demand through investment decisions in the economy.

Ludvigson, Steindel and Lettau (2002) investigate the relative significance of the wealth channel of monetary policy transmission in the New York economy using quarterly data from 1966 to 2000. Their study adopted a structural VAR approach and the results indicate only marginal causal link of monetary policy through asset values in their economy. Such marginal effect, the study suggest, is attributed to the transitory nature of the wealth channel in the transmission mechanism, thus necessitating the actions to make that channel permanent in the transmission mechanism for a more stronger effect in the economy.

Obafemi and Ifere (2015) compared monetary policy transmission in Nigeria using Factor Augmented Vector Autoregression (FAVAR) with the ability to accommodate large data sets and VAR model using only six data sets and found that the result of the transmission was relative. The results from the two model shows that the credit and the interest rate channels are significant transmission mechanism of monetary policy effect in Nigeria.

Samba (2013) examined the impact of common monetary policy transmission for the Central African Economic and Monetary Community (CEMAC) of Chad, Cameroon, Gabon, Equatorial Guinea, Congo, and Central African Republic using quarterly data from 1990 to 2007. Applying Vector Error Correction Model (VECM) on the data, he found that the impact of monetary policy on CEMAC is not uniform. More specifically, using the short term interest rate and the monetary aggregate alternatively as the policy instrument of the central bank in the zone, we show that output and inflation react differently after a monetary shock. He therefore argued that a common monetary policy will be in-effective for the region. No more different case was also observed for the East African Community by Davoodi, Dixit and Pinter (2013).

The ability of monetary policy to conduct itself effectively in the face of financial innovations has been stressed in the literature. Misati, Lucas, Anne and Shem (2010) investigated one such effect in Kenya by applying two stage least squares on monthly data from 1996 to 2007. In their results, they found that financial innovations dampened the monetary policy transmission especially the interest rate channel. They thus argued for constant revision of monetary policy to meet current innovations reforms.

Smal and Jager (2001) found that monetary policy in some African economy, particularly South Africa is forward looking due to policy targeting and hence the relative transmission to the economy may take some time. This means, the effect of the policy will alternate over time and so the effectiveness of a policy depends on the factors prevalent at the time.

3.0 Method of Study

3.1 Unit root test:

This study adopts the PP test for stationarity developed by Perron (1997). There is wider acceptability in the literature that the PP test evaluates the time series properties of the variables in the presence of structural changes at unknown points in time and thus endogenises these structural breaks, an advancement from the traditional augmented dickey fuller test of stationarity. The PP test is specified as:

$$\theta_{\alpha}^{*} = \theta_{\alpha}\left[\frac{\gamma_{\circ}}{\omega_{\circ}}\right]^{\frac{1}{2}} - \frac{T\left(\omega^{\circ} - \gamma^{\circ}\right)[se(\varphi)]}{2\omega_{\circ}\frac{1}{2}s} \qquad (1)$$

Where, φ is the estimate, and θ_{α} is the t-ratio of φ, $se(\varphi)$ is the coefficient standard error, and s is the standard error of the regression equation. $\omega°$ and $\gamma°$ are the residual spectrum at zero frequency and consistent estimate of the error variance respectively.

However, the PP test is not infallible. The test is susceptible to low power statistic and size distortion problems. Hence, to get rid of these challenges in our data, we also employ the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, which is believed to possess these challenges at a minimal rate (see for instance, McCarthy, 2015). A more clearly seen difference between the KPSS test and the PP test is in the statement of the null. In the KPSS, the null hypothesis is that the variable in question is stationary and the decision criteria is to accept the null only if the absolute value of the calculated statistic is below the critical value at the accepted level of significance (Ekong and Ekong, 2017).

The test statistic are obtained by regressing the residuals of a regression on the independent variables of the original regression and is given as:

$$KPSS = \frac{1}{T^{2}}.\frac{\sum_{t=1}^{T} S_{t}^{2}}{\varpi_{\infty}^{2}} \qquad (2)$$

Where, $S_t = \sum_{s=1}^{t} \hat{e}_s$ is a partial sum

ϖ_{∞}^2 is the HAC estimator of the variance of $\hat{e}_t$

T is the Sample size

3.2 Technique of Analysis:

We employ vector autoregression (VAR) to estimate the properties of the variables. One way of achieving this is by recursively placing restrictions on contemporaneous structure of the parameters, using the cholesky decomposition (see for instance Sims (1980). VAR model treats every endogenous variable in a system as a function of the lagged values of all of the endogenous variables in the system. The vector autoregression (VAR) is used for forecasting systems of interrelated time series variables and for analyzing the dynamic impact of random disturbances on the system of variables. Mathematically, a VAR is represented as,

$$y_t = \lambda_1 y_{t-1} + ... + \lambda_q y_{t-q} + \beta x_t + \mu_t \qquad \textbf{(3)}$$

where $\mathbf{y_t}$ is a vector of endogenous variables, $\mathbf{x_t}$ is a ^{c} vector of exogenous variables, $\boldsymbol{\lambda_1} \ldots \boldsymbol{\lambda_q}$ and $\boldsymbol{\beta}$ are matrices of coefficients to be estimated, and $\boldsymbol{\mu_t}$ is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

The vector of our endogenous variable g_t is

$$g_t = \begin{bmatrix} real\ gdp \\ money\ supply \\ interest\ rate \\ credit\ supply\ to\ economy \end{bmatrix} \qquad (4)$$

The study adopts the standard Autoregressive Distributed Lag (ARDL) model of Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001). This approach provides an easy investigation of dynamic relationship among variables of interest both in the long run and shot run period. The literature is of diverse opinion on the benefit of the ARDL bound testing model (for instance see, Akpan, (2011), Adamu and Darma, (2016), Nkoro and Uko (2016)). The long run relationship of the underlying variables is detected through the F-statistic (Wald test). In this approach, long run relationship of the series is said to be established when the F-statistic exceeds the critical value band. That is, if the computed F test value lies above the upper bound critical value, long run cointegration relationship exist among the variables. A computed F test value lower than the lower critical bound value is an indication of no

cointegration. Computed F test value in-between the two critical values are indication of inconclusive analysis.

The basic form of an ARDL (*p, q_1, q_2….q_m*) model is specified thus:

$$y_t = \sum_{i=1}^{\rho} \delta_\kappa y_{it-\rho} + \sum_{i=0}^{q} \beta_\kappa x_{it} + \mu_t \qquad (5)$$

Where,y_t, the explained variable; x_t, are the vector of explanatory variables in the model which could be endogenous or exogenous; μ_t, is a white noise variable assumed to serially independent of other variables in the model; *(p,q)*are the various lags of the variables in the model, ($\delta_\kappa, \beta_\kappa$) are estimated parameters to their lags $\kappa, and\ q = 1,2..m.$ An expansion of the above model to a standard bound testing procedure becomes:

$$\Delta Y_t = \delta_o + \sum_{i=1}^{\rho} \delta_\kappa \Delta y_{it-\rho} + \sum_{i=0}^{q} \beta_\kappa \Delta x_{it-q} + \psi_1 y_{it-1} + \psi_{2i} x_{it-1} + \mu_t \qquad (6)$$

Where, ψs, are the parameters of all the included variable in the model lagged one period, Δ, is the difference operator, other indices as already defined. For our analysis, the long run relationship between monetary policy and economic activity and prices is specified as:

$$\Delta rgdp_t = \delta_o + \sum_{i=1}^{\rho} \delta_1 \Delta rgdp_{it-\rho} + \sum_{i=0}^{q} \beta_0 \Delta ms_{it-q} + \sum_{i=0}^{q} \beta_1 \Delta mpr_{it-q} + \sum_{i=0}^{q} \beta_2 \Delta csp_{it-q} + \sum_{i=0}^{q} \beta_3 \Delta exr_{it-q} + \psi_1 rgdp_{it-1} + \psi_2 ms_{it-1} + \psi_3 mpr_{it-1} + \psi_4 csp_{it-1} + \psi_5 exr_{it-1} + \mu_t \qquad (7)$$

Where, *rgdp* is gross domestic product growth rate, *ms* is is money supply; *mpr* is monetary policy rate; *csp* is credit supply to the economy and *exr* is nominal exchange rate. Elsewhere, such as in equation (8) below, g_t is a measure of individual policy channel in the economy. Data for the study were sourced from data publications within the country such as CBN bulletin and other external publications like the World Bank Development country report for Nigeria.

$$\Delta rgdp_t = \delta_o + \sum_{i=1}^{\rho} \delta_1 \Delta rgdp_t + \sum_{i=0}^{q} \beta_i \Delta g_{it-1} + \psi_1 rgdp_{it-1} + \psi_2 g_{it-1} + \mu_{it} \qquad (8)$$

for i= 1,2,3,4

4.0 Analysis of Data

4.1 Variables Property:

Table A1 at appendix present the properties of the variables under consideration. Table A1 shows that the variables are multivariate normal as the probability of Jarque-Bera were all less than the test value. Real GDP was the only variable that was negatively skewed while credit supply to the private economy had the highest peak when viewed on a normal curve.

4.2 Unit root test:

Table 1 presents the result of unit root test for order of integration of the variables. The result shows a mix level of integration among the variables of interest. Interestingly, some of the variables were stationary at level when KPSS was employed but were stationary at first difference when PP was employed. This scenario reflects on us the seeming inclination to KPSS over PP as discussed earlier. Overall, our variables satisfy the stationarity requirement for the adoption of ARDL in our analysis.

Table 1: Unit root test

Variables	PP	KPSS	Order of Integration
rgdp	-3.989**	0.330***	1(0)
□	-2.968**	0.316***	1(0)
mpr	-2.816*	0.162***	1(1)
Δ*mpr*	-7.584***		
ms	-2.361	0.226***	1(1)
Δ*ms*	-8.113***		
csp	-2.536	0.186***	1(1)
Δ*csp*	-9.545***		
exr	0.472	0.683***	1(1)
Δ*exr*	-5.805***	0.161***	
Critical values			
1%	-3.632	0.739	
5%	-2.948	0.463	
10%	-2.612	0.347	

Note: *'**'*** represents significance at 10%, 5% and 1% level of significance respectively; regression with intercept;Δ indicates the 1st difference notation

Away from stationarity, we examine the desirability of our variables in the study using VAR technique following Guerra, Rodriguez, and Sänchez (1998). As pointed out earlier, the recursive exercise of VAR on our variables were only to give us more confidence that our variables were not selected by chance. They actually contribute in explaining our desired movement - the monetary policy-economic activity relations. None of our monetary variables failed to explain our target at least to some degree, even though their contributions were marginal. The results, reported in Table 2, shows that a one-time shock on monetary policy variables will not have any impact on economic activities, at least at the immediate time. However, when the effect will be felt, they revolve around the zero mean benchmark that will not be significant throughout the ten point period cumulatively.

Table 2: Accumulated response of *rgdp* to monetary policy variables

Period	RGDP	MS	MPR	CSP	EXR
1	3.458880	0.000000	0.000000	0.000000	0.000000
	(0.51541)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	4.328096	-0.119659	0.457551	0.464072	-0.054108
	(0.97918)	(0.72615)	(0.71922)	(0.67725)	(0.79097)
3	5.269580	0.717349	0.571815	0.458474	0.264326
	(1.44930)	(1.09464)	(1.16550)	(1.10117)	(0.85939)
4	5.738854	1.417989	1.086136	0.436800	-0.112105
	(2.15858)	(1.54356)	(1.51498)	(1.53071)	(1.21411)
5	5.956188	1.902895	1.337099	0.436979	-0.120636
	(2.78540)	(1.84559)	(1.94416)	(2.00183)	(1.45118)
6	6.158097	2.060392	1.100958	0.390286	-0.189572
	(3.45838)	(2.20137)	(2.32077)	(2.45391)	(1.73262)
7	6.148302	2.098541	0.952808	0.290149	-0.077972
	(4.17018)	(2.52396)	(2.86695)	(2.86865)	(2.09041)
8	6.040866	2.214019	0.829076	0.290898	0.032568
	(4.92687)	(2.90024)	(3.35167)	(3.32531)	(2.40201)
9	5.909453	2.399339	0.764521	0.357375	0.123841
	(5.72413)	(3.11396)	(3.88170)	(3.75221)	(2.84527)
10	5.768993	2.546447	0.728514	0.458795	0.199322
	(6.63144)	(3.43638)	(4.45548)	(4.15786)	(3.23206)

Choleskey Ordering: *rgdp, ms, mpr, csp, exr*.

Standard errors: Monte Carlo after 100 repetitions

Overall, all the monetary policy channels will affect economic activities in the economy by 16 percentage point in ten point period (see Table 3). Interest rate and credit supply channels provided above 1% influence on economic performance from the second period. However, a tenth point period investigation shows that money supply policy channel was more effective in Nigeria, with over 9% contributions, followed by interest rate channel with over 3% contributions cumulatively. With such stance we proceed to investigate their extended relationship with our ARDL model.

Table 3: Variance Decomposition of *rgdp*

Period	S.E.	RGDP	MS	MPR	CSP	EXR
1	3.458880	100.0000	0.000000	0.000000	0.000000	0.000000
		(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	3.627857	96.64197	0.108791	1.590668	1.636326	0.022244
		(8.31694)	(3.40087)	(5.53499)	(4.58318)	(4.10622)
3	3.855232	91.54243	4.810000	1.496416	1.449214	0.701938
		(10.4022)	(6.76918)	(5.92495)	(3.82033)	(4.59184)
4	3.997577	86.51726	7.545375	3.047040	1.350784	1.539542
		(12.2105)	(8.04555)	(7.86752)	(4.02183)	(5.53395)
5	4.040550	84.97606	8.825968	3.368348	1.322205	1.507414
		(13.2641)	(9.39400)	(8.61582)	(4.20466)	(5.84993)
6	4.056392	84.56141	8.907918	3.680983	1.325148	1.524544
		(13.9628)	(9.92413)	(8.62014)	(4.60282)	(6.47894)
7	4.062055	84.32634	8.891915	3.803743	1.382226	1.595776
		(14.7015)	(10.5022)	(9.19351)	(4.93637)	(6.69902)
8	4.068501	84.12909	8.944324	3.884191	1.377853	1.664543
		(15.2463)	(11.0096)	(9.30993)	(5.21630)	(7.01445)
9	4.076914	83.88612	9.114069	3.893249	1.398760	1.707802
		(15.6659)	(11.4261)	(9.59637)	(5.46676)	(7.35538)
10	4.084101	83.70944	9.211764	3.887332	1.455509	1.735953
		(16.0510)	(11.7145)	(9.79903)	(5.77467)	(7.53032)

Choleskey Ordering: *rgdp, ms, mpr, csp, exr*.

Standard errors: Monte Carlo after 100 repetitions

Next, we set the lag length for the ARDL model. Improper lag specification may lead to spurious estimates as some of the information in the system may be left in the error term. This was especially true when we were conducting our analysis. In-fact, our models, performs better with either inclusion or reduction of more lag order as directed by selection criterion. In the results of the lag order selection on Table 4, both Schwarz information criterion (SIC) and Hannan-Quinn (HQ) information criterion select lag

of order 1, whereas: Akaike information criterion (AIC), Final prediction error (FPE) and the sequential modified LR test statistic (each test at 5% level), chooses lag of order 2. This study tested the two lags proposition and work with the model with better performance.

Table 4: VAR Lag Order Selection Criteria

Lag	logL	LR	FPE	AIC	SIC	HQ
0	-559.5138	NA	1820000	33.2067	33.4312	33.2832
1	-474.5017	140.0198	5421349	29.6766	31.0234*	30.1359*
2	-443.2250	42.31563*	4149556*	29.3074*	31.7765	30.1494

Note: * indicates the lag order selected by the criterion.

Having dealt with the issues of lag selection, we proceed to our autoregressive distributed lag (ARDL) analysis. First, we examined the long run relationship for the individual channels of monetary policy, and next the joint relationship of all the four channels and report the results on Table 5. Our result shows that there exists a long run relationship for some monetary policy channels with economic activities in Nigeria. Specifically, we found that the money supply, the interest rate and the exchange rate channels were important in fine-tuning the economy within the period. However, the power of money supply channel will be more felt than others. A 1% increase in money supply will increase economic activity by 25% in the future. Within the immediate time, money supply will significantly affect the economy negatively by 20%[1].

Table 5: ARDL bound test results

Channels	Estimated Variables	Lag order	Calculated F-Statistics	Any long-run relationship?
Money	*rgdp*	*2*	6.98***	Yes
supply	Δms	*1*		
Interest rate	*Rgdp*	*2*	5.81***	Yes
	Δmpr	*1*		
Credit	*Rgdp*	*2*	5.02	Inconclusive
supply	Δcsp	*3*		
Exchange	*Rgdp*	*2*	5.83***	Yes
rate	Δexr	*1*		
Joint	*Rgdp*	*2*	2.01	No

channels	Δms	Δmpr	Δcsp	Δexr^{μ}					
Bound test critical values	1%			5%			10%		
	1(0)	1(1)		1(0)	1(1)		1(0)	1(1)	
	6.84	7.84		4.49	5.73		4.04	4.74	

Note: bounds critical values are as provided by Pesaran, et al (2001)

*** denote significance at 5 %

$^{\mu}$ lag based on individual specification

Similarly, a 1 unit change in the interest rate channel will affect economic activities by 0.68 units. The effect may be positively insignificant in the short run, but as time passes, the negatively significant relationship between interest rate and income of the IS-LM analysis is reinforced.

The influence of exchange rate channel though positive, will not be significant both in the short or the long run. The exchange rate-economic growth interactions in the model in marginal. An almost one for one effect will be realized even in the long run. This shows that, although the literature acknowledged the exchange rate channel as existing in Nigeria, its influence on the economy, may to a large extent depends on the structural peculiarities of the economy. A mono-culture economy like our consciously delimit her subject of policy integration as shown above.

Cumulatively, all the channels on monetary policy transmission in Nigeria failed to relate with the economy at the long run. This may be a possible outcome of spillover effect of the global financial crisis that rocked the world economies in recent times and culminating in a recess economy as we currently experienced. Or it may have aroused due to policy inconsistencies and reversals that were experienced during the period under review.

4.3 Discussion and policy options

One of the major findings of this study is that, taken as a whole, monetary policy transmission does not have any long term economic growth nexus in Nigeria. Such dismal outcome reinforced the opinion of many experts of the subject in recent times that central banks should emphasize price stability as a single objective of monetary policy and eschew consideration of other goals such as growth or employment. In the words of Kamin et al (1998), this “desire to limit the objectives of monetary policy in this way is based on the near-unanimity among economists and policy-makers that monetary policy cannot affect the long-term growth of the economy. In this view, efforts to stimulate growth above its potential rate merely lead to higher inflation: accordingly, monetary policy can at most only moderate shortrun fluctuations in output”. One way of dealing with such dismal performance, in the light of the current recession is by making monetary policy more fiscal in nature. Theory and experience has shown

that monetary policy will not work well in recession or even depression. However, fiscal policy does. Therefore, a monetary policy that focuses on increasing deficit to the government may be plausible from the position of this paper for recessionary recovery. If more funds can get to the purview of the government through any monetary policy stimulus, say by increased domestic debt, then, from the fiscal side, growth trajectories can be pursued for a long-term impact on the economy.

However, when the model was disaggregated to check the feasibility of each transmission channels, we found that money supply conduit, interest rate conduit and exchange rate conduit were significant transmission channels for Nigeria. Money supply and interest rate conduits delivers more positive significance in the study period. Thus we adjudge that policy makers should rely more on these conduits given their contemporaneous speed in transmitting policy feeds on the economy. Credit supply conduit failed in long-term test. We attributed this failure to three reasons. First, the huge collaterals requirement by finance administrators that serve as bottlenecks in recent times to genuine creditors and second, to increasing non-performing loan burden bore by the system within the period. Third, Loan application and grants, to short-term trade that may not really capture long-term impact. Overcoming this challenge for future improvement of this channel should involve Corporate Private Partnership (CPP) regulatory reforms that strengthen the credit worthiness standards of lending institutions in Nigeria.

5.0 Conclusion

The study investigated the channels of monetary policy transmission in Nigeria for the past three and a half decades. Our findings show that the credit supply transmission channel of monetary policy was not effective during the study period. However, the interest rate, money supply, and the exchange rate channels effectively supported economic activities in Nigeria during the period. Jointly, monetary policy did not explain economic activities over the past thirty years in Nigeria. Given that Nigeria is struggling to grow out of recession, we recommend monetary policy that is more fiscal in nature and using specific monetary policy instrument for specific economic issue(s) afterwards, given that this seems to correlate well with economic performance over time, among others.

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Appendix

Table A1: Descriptive properties of the variables

Variabes/ properties	*rgdp*	mpr	ms	csp	exr
Mean	4.066111	12.70389	24.35000	14.98611	76.33376
Median	5.000000	12.60000	21.89500	13.30000	82.72830
Maximum	11.00000	26.00000	43.27000	38.40000	192.4400
Minimum	-13.00000	6.000000	13.23000	8.700000	0.346100
Std. Dev.	4.707025	4.228292	6.573916	6.107239	64.29916
Skewness	-1.499400	0.718754	0.771270	2.483124	0.028036
Kurtosis	6.352290	4.120743	3.410555	9.374213	1.437988
Jarque-Bera	30.34597	4.983742	3.821980	97.94131	3.664538
Probability	0.000000	0.082755	0.147934	0.000000	0.160050
Sum	146.3800	457.3400	876.6000	539.5000	2748.015
Sum Sq.Dev.	775.4631	625.7459	1512.573	1305.443	144703.4
Observations	36	36	36	36	36

Table A2: Regression outputs of the ARDL models

Dependent Variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.777410	8.296721	-0.093701	0.9265
D(RGDP(-1))	-0.175857	0.243454	-0.722340	0.4805
D(RGDP(-2))	-0.340574	0.159578	-2.134210	0.0486
D(MS(-1))	-0.584782	0.301789	-1.937714	0.0705
D(MPR(-1))	0.277129	0.296522	0.934599	0.3639
D(MPR(-2))	0.258149	0.295945	0.872288	0.3960
D(MPR(-3))	0.119456	0.238361	0.501157	0.6231
D(CSP(-1))	0.355810	0.360604	0.986705	0.3385
D(CSP(-2))	-0.164601	0.210701	-0.781206	0.4461
D(CSP(-3))	0.008484	0.176638	0.048032	0.9623
D(EXR(-1))	-0.027472	0.074357	-0.369463	0.7166
RGDP(-1)	0.295559	0.283452	1.042712	0.3126
MS(-1)	-0.012596	0.360102	-0.034978	0.9725
MPR(-1)	-0.014731	0.352108	-0.041836	0.9671

CSP(-1)	0.331858	0.520716	0.637311	0.5329
EXR(-1)	-0.000205	0.018928	-0.010809	0.9915

R-squared	0.527918	Mean dependent var	5.011875
Adjusted R-squared	0.085342	S.D. dependent var	3.392857
S.E. of regression	3.244853	Akaike info criterion	5.498870
Sum squared resid	168.4651	Schwarz criterion	6.231738
Log likelihood	-71.98192	Hannan-Quinn criter.	5.741795
F-statistic	1.192830	Durbin-Watson stat	1.724968
Prob(F-statistic)	0.364299		

Table A3

Dependent Variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.882749	2.749630	-0.684728	0.4994
D(RGDP(-1))	-0.424031	0.176102	-2.407878	0.0231
D(RGDP(-2))	-0.198801	0.134572	-1.477292	0.1512
D(MS(-1))	-0.204400	0.110913	-1.842886	0.0764
RGDP(-1)	0.632223	0.171461	3.687262	0.0010
MS(-1)	0.159970	0.098971	1.616325	0.1177

R-squared	0.386774	Mean dependent var	4.708485
Adjusted R-squared	0.273214	S.D. dependent var	3.766862
S.E. of regression	3.211316	Akaike info criterion	5.334204
Sum squared resid	278.4389	Schwarz criterion	5.606297
Log likelihood	-82.01437	Hannan-Quinn criter.	5.425755
F-statistic	3.405891	Durbin-Watson stat	1.639768
Prob(F-statistic)	0.016308		

Table A4

Dependent Variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.994132	2.467411	2.834604	0.0092
D(RGDP(-1))	-0.193603	0.182650	-1.059967	0.2997
D(RGDP(-2))	-0.317929	0.142336	-2.233645	0.0351
D(MPR(-1))	0.234635	0.198552	1.181729	0.2489
D(MPR(-2))	0.105541	0.184523	0.571965	0.5727
D(MPR(-3))	0.060647	0.172969	0.350624	0.7289
RGDP(-1)	0.427134	0.172229	2.480031	0.0205
MPR(-1)	-0.290976	0.173074	-1.681225	0.1057

R-squared	0.344658	Mean dependent var	5.011875
Adjusted R-squared	0.153517	S.D. dependent var	3.392857
S.E. of regression	3.121582	Akaike info criterion	5.326875
Sum squared resid	233.8626	Schwarz criterion	5.693309
Log likelihood	-77.23000	Hannan-Quinn criter.	5.448337
F-statistic	1.803158	Durbin-Watson stat	1.797343
Prob(F-statistic)	0.132974		

Table A5

Dependent Variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.833595	1.111434	1.649755	0.1106
D(RGDP(-1))	-0.312301	0.187406	-1.666440	0.1072
D(RGDP(-2))	-0.136795	0.142115	-0.962570	0.3443
D(EXR(-1))	0.038157	0.052894	0.721392	0.4769
RGDP(-1)	0.566682	0.196598	2.882445	0.0076
EXR(-1)	0.003343	0.011267	0.296737	0.7689

R-squared	0.309502	Mean dependent var	4.708485
Adjusted R-squared	0.181632	S.D. dependent var	3.766862
S.E. of regression	3.407643	Akaike info criterion	5.452884
Sum squared resid	313.5248	Schwarz criterion	5.724977
Log likelihood	-83.97259	Hannan-Quinn criter.	5.544435
F-statistic	2.420442	Durbin-Watson stat	1.644699
Prob(F-statistic)	0.061625		

Table A6

Dependent Variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.251953	2.013482	-0.125133	0.9015
D(RGDP(-1))	-0.151706	0.177884	-0.852837	0.4022
D(RGDP(-2))	-0.289240	0.133610	-2.164806	0.0406
D(CSP(-1))	-0.183961	0.124549	-1.477015	0.1527
D(CSP(-2))	-0.131421	0.125819	-1.044520	0.3067
D(CSP(-3))	-0.049075	0.121900	-0.402581	0.6908
RGDP(-1)	0.334065	0.180738	1.848340	0.0769
CSP(-1)	0.255788	0.134890	1.896275	0.0700

R-squared	0.379353	Mean dependent var	5.011875
Adjusted R-squared	0.198330	S.D. dependent var	3.392857
S.E. of regression	3.037829	Akaike info criterion	5.272481
Sum squared resid	221.4817	Schwarz criterion	5.638915

Log likelihood	-76.35970	Hannan-Quinn criter.	5.393944
F-statistic	2.095614	Durbin-Watson stat	1.763916
Prob(F-statistic)	0.083605		