Microeconomics and Macroeconomics 2018, 6(3): 55-66
DOI: 10.5923/j.m2economics.20180603.01

Monetary Policy Transmission in Nigeria: How Important is Asset Prices Channel?[i]

Adekunle P. A., Baba N. Yaaba*, Stephen S. A., Ogbuehi F., Idris A., Zivoshiya P. B.

Department of Statistics, Central Bank of Nigeria, Abuja, Abuja, Nigeria

Abstract Using a multi-model approach including Johansen and Autoregressive Distributed Lag (ARDL) techniques, the study assesses the prevalence of the channels of monetary policy transmission mechanism in Nigeria to determine the position of asset prices channel with emphasis on equity channel of Monetary Policy Transmission Mechanism (MPTM). The study covers all the four prominent channels of MPTM in Nigeria – Interest rate, exchange rate, credit and equity channels – over the period 1985Q1 to 2017Q4. The data was used from two perspectives: raw and normalized data such that four set of regressions were carried out and the best model determined based on the one that yield the lowest information criteria. Overall, the results return exchange rate channel as the most prevalent, while equity channel occupies third position. Consequently, the study suggests close monitoring of the market by the Central Bank of Nigeria (CBN) so as to be able to take proactive policy decisions since disruption in the market is likely to affect the general price level which is the primary mandate of the CBN.

Keywords ARDL, Johansen, Monetary Policy Transmission Mechanism

1. Introduction

The primary instrument of price stability-oriented monetary policy is interest rate; hence the traditional interest rate channel is recognized by most economists as the most effective channel of monetary policy transmission (MPT). Changes in interest rate *ceteris paribus* do have some level of impact on output and the general price level. Evolving economic theory and recent development experience has however revealed other transmission channels through which the level of economic activity and prices can also be affected.

Assets prices channel is increasingly gaining recognition as important means for the realization of monetary policy goals considering their role as a component or mechanism of monetary policy transmission. Economic theory had long recognized asset prices as one of the critical indicators of financial equilibrium[1], of which any disruption distort the market leading to systemic crisis.

More so, a consensus is gradually emerging that the long-run objective of price and financial stability are mutually supportive. Stability in the general price level reduces speculative activities in the asset market, which in-turn stabilizes prices and consequently strengthens the stability in the overall financial system. In another dimension, monetary policy decisions geared through the traditional interest rate channel affects households. Higher interest rate, for instance, can serve as an incentive to lower equity prices, which in-turn results to fall in financial wealth and by implication fall in aggregate investment and consumption spending. Asset prices can therefore play a significant role in monetary policy not only as a channel of MPT but also as an important indicator of future expectations through the provision of vital signals about price stability related risks which is the ultimate goal of Monetary Policy (MP). The value of assets is also generally agreed to be one of the critical determinants of the balance sheets of financial intermediaries and to some extent influence their appetite for risk.

Asset prices identifiable in monetary economics include; exchange rate, share/equity prices and property prices[2]. Considering the essential and evolving roles of asset prices, there is the strong need to examine on continuous basis not only the potency of the channel but also the changing pattern of its effect as MPTM in order to enable monetary authorities take proactive policy actions. This study is therefore an attempt to determine the prevalence of asset prices channel of MPTM in Nigeria with a view to guide monetary authority in taking monetary policy decision. Asset prices are best proxy by property prices in developing countries including

* Corresponding author:
bnyaaba@cbn.gov.ng (Baba N. Yaaba)
Published online at http://journal.sapub.org/m2economics

1 See Gantnerova (2004).

2 Others include credit to enterprises and households.

Nigeria due to under developed equity market arising in some cases to low participation. However, due to absence of data on property prices, the study uses equity prices to represent the channel.

To achieve the objective, the study is divided into five sections including this brief introduction. Section two reflects on the theoretical foundation of monetary policy transmission mechanism and relevant empirical literatures, while section three details the methodologies. Section four discusses the result and section five concludes and proffers some policy actions.

2. Literature Review

2.1. Theoretical Foundation

Monetary policy is generally believed to have significant impact on financing conditions of the economy. Besides its effect on the cost of capital, it also impact on the credit creation capability of banks through availability or otherwise of loanable funds as well as reshape banks appetite for specific risks. Monetary policy changes agents' expectations about the level of economic activities, the probable level of general prices as well as the pattern of consumption and investment. For instance, downward adjustments in the cost of borrowing increase both consumption and investment spending, which can be achieved with accommodative monetary policy arising from reduction in interest rate. The knowledge of the stance of monetary policy helps in the formation of expectations about the strength of economic activities. This is capable in prompting banks to ease/tighten their lending policy, which improves/worsens spending by both the households and firms. Easing or tightening of lending policies brings about low/high interest rate, which in turn leads to decline/increase in savings capable of attracting/distracting investors to/from the stock market.

At the heart of this study are the theories that characterize the channel which affects asset prices, namely: exchange rate and equities channels of monetary policy transmission mechanisms.

2.1.1. Exchange Rate Channel of Monetary Policy Transmission

The view on exchange rate channel of monetary policy transmission takes two dimensions, following Loayza and Hebbel (2002), namely: aggregate demand and aggregate supply effects. The aggregate demand effect occurs when the domestic real interest rates falls in an accommodative monetary policy environment and the fall induce higher net-exports which in turns strengthens aggregate demand but triggers domestic currency depreciation. Aggregate supply effect, on the other hand occurs when expansionary monetary policy raises the domestic prices of imported goods through real depreciation of the domestic currency, which directly affects inflation. In other words, the higher price of imported intermediary goods reduces aggregate supply through decline in the level of input thereby affects outputs, hence prices increase. More so, higher prices of imported finished goods arising from depreciation in the value of the domestic currency affects aggregate demand through higher prices of goods in the domestic economy (see Yaaba, 2018 for more details).

Monetary policy transmission through exchange rate channel however largely depends on the exchange rate regime. In a free floating regime, monetary policy shocks are fairly easily transmitted when compared to a fixed regime. According to Mishkin (1996) and Loayza and Hebbel (2002), monetary sector is often adjusted to support fixed exchange rate and this is schematically presented as:

$$M \uparrow \Rightarrow i_r \downarrow \Rightarrow E \downarrow \Rightarrow NX \uparrow \Rightarrow Y \uparrow \quad (S1)$$

From S1, accommodative monetary policy ($M \uparrow$) leads to fall in domestic interest rate ($i_r \downarrow$), which triggers domestic currency depreciation ($E \downarrow$), that could culminate in rise in net-exports ($NX \uparrow$) and consequently increase in aggregate output ($Y\uparrow$).

2.1.2. Equity Channel of Monetary Policy Transmission

There are two critical channels, relevant to this paper that can be identified under the equities channel of monetary policy transmission. These are: investment effect and wealth effect on consumption.

Investment Effect

The investment effect can be viewed from the perspective of Tobin's *q* theory of investment which explains a mechanism that transmits the effect of monetary policy to other sectors of the economy through its impact on the assessment of equities (Tobin 1969).

Tobin proposed the general equilibrium theory (popularly referred to as Tobin 'q' or 'q' theory). The theory is defined as:

$$eq_t = \frac{v_t}{rc_t} \quad (1)$$

Where q is the ratio of market value of firms existing shares to the replacement cost of the firms physical assets, v is the market value of firms and rc represents the replacement cost of capital and the subscript t is the time dimension. Higher q translates to higher market prices of firms' vis-à-vis the replacement cost and new plants and equipment become relatively cheaper when compare to the market value of firms. If the issued stocks become dearer in relation to the cost of plants and equipment, there will be increase in investment arising from increase in the acquisition of new plants and equipment.

View differently, the firm attains equilibrium with q equals one. Any point of q greater than one signals the need for further investment because profit will be higher than the cost of firm's assets, but when q is less than one, the firm is better-off reducing its assets. Therefore, it is logical to assume that an expansionary monetary policy may lead to increase in the demand for stocks, hence rise in stocks prices, which could trigger increase in investment and consequently enhances aggregate demand.

With the above analysis of the workings of Tobin's q, it follows that, accommodative monetary policy raises the purchasing power of the masses, which in-turn induces spending, part of which constitute investment in the stock market, thus raises the demand for equities and consequently increase in prices. This, following Mishkin (1996), can be schematically presented as:

$$M \uparrow \Rightarrow P_e \uparrow \Rightarrow q \uparrow \Rightarrow I \uparrow \Rightarrow Y \uparrow \text{ (S2)}$$

From S2, as monetary policy becomes liberal (M ↑), equity prices rises (P_e ↑) leading to increase in q (q ↑) through increase in investment (I ↑) and consequently aggregate output increases (Y ↑).

Wealth Effects

Ando and Modigliani (1963), 'Life Cycle Hypothesis' hypothesized that individual consumption decisions are based not only on current income but also on the life time savings which includes human capital, real capital and financial wealth. The hypothesis contends that individuals build assets at their working ages to rely on at retirement. These assets include financial wealth comprising mostly of common stocks. Mathematically, the working of 'Life Cycle Hypothesis' can be illustrated as:

$$C = \frac{W+AY}{L} \quad (2)$$

Where *C, L, W, Y* and *A* are consumption, consumer's life expectancy rate, wealth, annual income and retirement age, respectively. The analysis of equation 2 can take two dimensions:

First: assuming interest rate is zero over the life time of a given consumer; his resources can mimic his initial wealth (*W*) and life time income (*AY*). Second: if we assume a positive interest rate such that savings attracts interest which has to be accounted for, then the consumer with *L* life expectancy will attain optimal allocation of his time resources in a way that annually he consumes:

$$C = \frac{1}{L}W + \frac{A}{L}Y \quad (3)$$

Hence, aggregate domestic consumption becomes:

$$C = \alpha W + \beta Y \quad (4)$$

Where *C* represents aggregate consumption, α denotes the marginal propensity to consume for wealth (*W*) and β stands the marginal propensity to consume for income (*Y*).

When income stops after retirement then *Y* becomes zero (i.e. Y= 0) and consumption will become a function of *W*, hence:

$$C = \delta W \quad (5)$$

Given the assumption that a substantial part of financial wealth is in stocks, the value of financial wealth is directly proportional to the prices of stocks. Thus, as the stock prices rise, the value of financial wealth also rises translating to rise in the life time wealth of the consumer which in-turn affects the level of consumption.

Following S2, which demonstrates that expansionary monetary policy positively affects stocks prices, it therefore follows that another monetary policy transmission mechanism with regard to equity, following Ando and Modigliani 'Life-Cycle Hypothesis' has ensued. This can be schematically presented as:

$$M \uparrow \Rightarrow P_e \uparrow \Rightarrow W \uparrow \Rightarrow C \uparrow \Rightarrow Y \uparrow \text{ (S3)}$$

The schematic representation S3 indicates that" as monetary policy becomes accommodative (M↑), equity prices (P↑) rises leading to increase in wealth (W↑) of the consumer which further raises the aggregate consumption (C↑) and aggregate output (Y↑) and vise vasa.

2.2. Review of Empirical Literature

Hung (2007) using seasonally adjusted quarterly data for Vietnam from 1996Q1 to 2005Q4 applied Vector Autoregression (VAR), impulse response function, Granger causality test and variance decomposition to evaluate the effect of monetary shocks on output. The results return credit and exchange rate channels as the most effective channel in transmitting monetary shocks to real sector of the economy during the study period.

In their effort to evaluate the monetary policy transmission mechanism for Nigeria, Adenekan and Ahortor (2010) employ VAR on Nigerian data spanning 2000 through 2009 and found that credit, interest rate and exchange rate channels are weak in transmitting monetary policy shocks to the other sectors of the economy, reflecting weak and shallow financial system. They submitted that Central Bank of Nigeria is far more focused on price stability than growth generation.

Yang, Davies, Wang, Dunn and Wu (2011) applying autoregressive distributed lag (ARDL) approach on data from 2000 to 2009, assess the interest rate and credit pass-through after the global financial crisis of 2007/08 of the Pacific Island countries including Fiji, PNG, Samoa, Solomon Islands, Tonga and Yanuatu. The study finds that monetary policy transmission was weak during the study period probably due to weak credit demand and under-developed financial markets. They therefore highlighted the importance of a highly deepened financial market as well as proper coordination of macroeconomic policies and tools with emphasis on exchange rate flexibility.

Onyemachi and Lezaasi (2012) examine the bank's assets channels of monetary policy transmission for Nigeria as well as determine the direction of causality among the instruments of monetary policy. The study applied co-integration and error correction model on Nigeria annual data from 1970 to 2010 within the context of a Keynesian framework. The results conformed to the theoretical expectation, as bank's assets channels (BKA) and money supply (MNS) returns positive and significant coefficients. The Granger causality test shows a unidirectional causality between BKA and MNS as well as cash reserve ratio and money supply.

Nwosa and Sabi (2012) apply unrestricted vector autoregression model on Nigeria quarterly data from 1986Q1 to 2009Q4, to examine the monetary policy transmission mechanism for Nigeria. The result shows that interest rate channel is the most effective monetary policy transmission channel especially to Agriculture and Manufacturing sectors, while exchange rate channel proves to be the most effective to building/construction, mining, services and wholesale/retail sectors.

Abaenewe and Ndugbu (2012) assess the impact of monetary policy rates on equity prices on the Nigeria stock market. The study adopted ordinary least square (OLS) on five different monetary policy instruments including minimum rediscount rate, treasury bill rate, interest rate and exchange rate using annual data from 1985-2010. The result shows that all the variables are insignificant. The study therefore conclude that equities market do not effectively respond to monetary policy decisions. It therefore, recommends that monetary authority should effectively align their monetary policy decision to equity market activities so as not only to boost investment but to also enhance price stability.

Davoodi, Dixit and Pinter (2013) adopted a multi model approach to assess the efficacy of the channel of monetary policy transmission for countries of East African Community which includes Kenya, Tanzania, Uganda, Rwanda and Burundi. The technique used in the study covers Recursive Structural VAR, Bayesian VAR and Factor Augmented VAR. the empirical result, in a nutshell; show a mixed results as different techniques yield different results. For instance, the monetary transmission mechanism is generally weak for all the study countries when standard statistical technique is adopted but the reverse when non-standard statistical technique is used. Overall the study submits that the relative importance of transmission mechanism varies across countries.

Bernhard (2013) in an attempt to determine the most effective transmission channel for monetary policy in Nigeria applies Granger causality test on three transmission channels and some selected macroeconomic aggregates. The study utilizes annual data from 1970 to 2011 and found that interest rate has the strongest impact. The study concludes that only three channels are functional i.e. interest rate, exchange rate and the credit channels. They recommend that the three channels should form the basis for inflation targeting.

Williams and Robinson (2014) evaluate the impact of monetary policy shocks on macroeconomic variables including the level of economic activities, inflation, money & credit, Treasury bill rates and equity prices. The study utilized quarterly data from 1998Q1 to 2013Q1. The results show that changes in interest rate impacted positively on inflation. The study thus suggests the need to strengthen the credit channel of monetary policy prior to the country's transition to full-fledged inflation targeting.

Ngozi and Eugene (2015) test the strongest and most dominant monetary policy transmission channels to monetary shock using a combination of FAVAR and traditional VAR. The study utilized quarterly data from 1970 to 2013. The results show that interest rates and credit channel are the leading channels for monetary policy transmission mechanism in Nigeria. It recommends that interest rate and credit channels should be improved upon by central bank so as to improve their efficiency in the conduct of monetary policy to enhance economic growth.

Frances and Eugene (2015) investigate the effectiveness and dominance of the channels of monetary policy by applying FAVAR on 53 different variables from the first quarter of 1970 through the last quarter of 2013. The results show that interest rate and credit channels are the dominant and most effective monetary policy transmission channels in Nigeria, followed by Exchange rate channel. Thus, recommend that Central Bank of Nigeria (CBN) should rely more on these channels as policy variables in the conduct of monetary policy.

Bungin, Reljic and Ivkovic (2015) adopted an unrestricted VAR to determine the significance of exchange and interest rate channels of monetary policy transmission mechanism for Serbia using monthly data from 2007:01 to 2014:12. The results reveal that although interest rate plays a role but exchange rate channel has the strongest effect on inflation in the country during the study period.

In an attempt to determine the relative importance of the channels of monetary policy transmission in Poland, Kapuscinski, *et. al* (2015) applied SVAR on Polish data from January 2001 to March 2015. They found that there was a sharp decline in the relevance of exchange rate channel in transmitting monetary shocks to other sectors of the economy hence exchange rate channel, according to the authors, was relatively weaker and less effective during the study period. They attributed the weakening of the channel to variations in the production process arising from massive entry of international enterprises. They concluded that movement in inflation was largely a function of interest rate channel which turn-out to be the strongest.

3. Methodology and Data Issues

3.1. Johansen Cointegration Test

Johansen methodology as contained in Vector Autoregression (VAR) of order ρ is obtained from:

$$y_t = \alpha + \Pi_1 y_{t-1} + \Pi_2 y_{t-2} + \cdots + \Pi_\rho y_{t-\rho} + \mu_t \quad (10)$$

Where y_t is an *n x 1* vector of I(1) variables and μ_t is an *nx1* vector of Gaussian white noise disturbances. The VAR model can be reformulated as:

$$\Delta y_t = \alpha + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \mu_t \quad (11)$$

Where:

$$\Pi = \sum_{i=1}^{\rho} A_i - I \text{ and } \Gamma_i - \sum_{j=i+1}^{\rho} A_j$$

With reduced rank of coefficient matrix Π, r < n, and nXr matrices of α and β each with rank r will ensue such that Π = αβ' and $\beta' y_t$ is stationary. In this case r is the number of the cointegrating relationships, while α is the adjustment parameters in the vector error correction model (VECM), each column of β is a cointegrating vector. For any given number of the cointegrating relationships (r), the maximum likelihood of estimator of β is an indication of a combination of change in y_t (Δy_t) such that y_{t-1} will correct for lagged differences and deterministic variables if present. Two different likelihood ratio tests of the significance of the relationships are available for Johansen as well as the reduced rank of the Π matrix, namely: the trace test and maximum Eigen value test. These tests are presented as equations 12 and 13, respectively.

$$J_{trace} = -T\sum_{i=r+1}^{n} ln\left(1-\hat{\lambda}_i\right) \quad (12)$$

$$J_{max} = -Tln\left(1-\hat{\lambda}_{r+1}\right) \quad (13)$$

Where T is the sample size and $\hat{\lambda}_i$ is the *i'th* largest canonical correlation. The maximum eigenvalue tests the null hypothesis of r cointegrating vectors against alternative hypothesis of $r+1$ cointegrating vectors.

In other words, the decision rules upon which to accept or not, the existence of long run relationship between variables is that the TRACE statistics value and their respective critical values are at an appropriate level of significance. If TRACE statistics value is greater than the critical value, the null hypothesis is rejected. On the other hand, if TRACE statistics value is less than the critical value, the null hypothesis is not rejected. The hypothesis indicates the number of cointegrating equations.

3.2. Autoregressive Distributed Lag Approach

Following Pesaran, Shin and Smith (2001), the autoregressive distributed lag (ARDL) approach to Cointegration is formulated as:

$$\Delta l\pi_t = \sum_{i=1}^{\rho}\beta_i\Delta l\pi_{t-i} + \sum_{j=0}^{\rho}\delta_j\Delta lX_{t-j} + \omega_1 l\pi_{t-1} + \omega_2 lX_{t-1} + \mu_t \quad (14)$$

Where π is consumer price index (CPI), X is a vector of the independent variables, Δ is a difference operator, ρ is the optimal lag length of the model, β and δ are the coefficients of the short-run parameters, $\omega_{,s}$ are the coefficients of the long-run parameters, l denotes natural logarithm and μ is the error term.

Following Granger representation theorem, the error correction version of equation (14) is reformulated as:

$$\Delta l\pi_t = \sum_{i=1}^{\rho}\beta_i\Delta l\pi_{t-i} + \sum_{j=0}^{\rho}\delta_j\Delta lX_{t-j} + \Omega ECM_{t-1} + \mu_t \quad (15)$$

Where ECM is the error correction version of equation (14). All other variables are as defined under equation (14).

4. Discussion of Results

The results are discussed from two perspectives. The first perspective which explores the characteristics of the data use for the estimation considers the descriptive statistics, correlation analysis and stationarity tests. The second perspective takes care of the regression analysis and post estimation diagnostic tests. Both perspectives consider both the raw and normalized data series.

Summary Statistics

Table 1 presents the descriptive statistics of variables used for the estimation at both the contemporaneous and normalized levels. The upper region of the table shows the descriptive statistics of the data at the contemporaneous level, whereas the lower part of the table presents same at the normalized level. Close scrutiny of the table shows that there are one hundred and thirty-two (132) observations per each variable. The minimum value of the distribution is 0.88 for Consumer Price Index (CPI) while the maximum value is 63,016.56 for All Share Index (ASI). The distribution is positively skewed as portray by positive coefficient of skewness of all the variables. The kurtosis of the distribution ranges from 3.01 for CPI and 4.11 for MPR. The minimum Jarque-Bera stands at 8.36 for *exr*. The summary statistics for raw data, in a nutshell, reveals that the distribution is asymmetrical. Conversely, the normalized data shows that all the variables are negatively skewed with -0.65, -0.66, -0.84, -1.06 and -1.72 for *exr*, *mpr*, *asi*, *cpi* and *cps*, respectively.

Table 1. Summary Statistics

			Raw Data		
	cpi	***mpr***	***Exr***	***cps***	***asi***
Mean	60.12	13.65	102.68	4661.58	15398.02
Median	36.90	13.50	118.07	736.06	9717.00
Maximum	234.17	26.00	348.00	22739.69	63016.56
Minimum	0.88	6.00	3.18	12.91	113.40
Std. Dev.	61.05	3.92	81.12	6837.78	15268.75
Skewness	1.01	0.65	0.62	1.32	0.88
Kurtosis	3.01	4.11	3.17	3.26	3.05
Jarque-Bera	21.96	15.98	8.36	37.88	16.88
Probability	0.00	0.00	0.02	0.00	0.00
Observations	132	132	132	132	132
			Normalized Data		
Mean	0.75	0.62	0.70	0.82	0.75
Median	0.85	0.63	0.67	0.98	0.83
Maximum	1.00	1.00	1.00	1.00	1.00
Minimum	0.00	0.00	0.00	0.00	0.00
Std. Dev.	0.26	0.19	0.24	0.28	0.24
Skewness	-1.06	-0.66	-0.65	-1.72	-0.84
Kurtosis	3.17	4.17	3.10	4.80	2.99
Jarque-Bera	24.77	16.99	9.21	83.00	15.67
Probability	0.00	0.00	0.01	0.00	0.00
Observations	132	132	132	132	132

Correlation Matrix

As presented in Table 2, for the raw data, *cpi* recorded a negative coefficient of 0.37 with *mpr*. *cpi* verses *asi* recorded a positive coefficient of 0.76; *cpi* versus *exr* yield a positive coefficient of 0.92 and *cpi* returns the highest positive correlation of 0.95 with *cps*.

Overall therefore, all the variables are positively correlated with *cpi* except *mpr*. This is in line with theory and conforms to conventional wisdom. The normalized data yield results that are similar to that of the raw data except that the magnitude of the coefficients varies.

Table 2. Correlation Coefficients

	cpi	***mpr***	***exr***	***cps***	***asi***
Raw Data					
cpi		-0.37	0.92	0.95	0.76
mpr	-0.37		-0.24	-0.27	-0.45
exr	0.92	-0.24		0.83	0.74
cps	0.95	-0.27	0.83		0.57
asi	0.76	-0.45	0.74	0.57	
Normalized Data					
cpi		-0.34	0.93	0.95	0.75
mpr	-0.34		-0.23	-0.25	-0.44
exr	0.93	-0.23		0.85	0.74
cps	0.95	-0.25	0.85		0.57
asi	0.75	-0.44	0.74	0.57	

Unit Roots Tests

Table 3 presents the unit root test of the variables conducted using Augmented Dickey-Fuller (ADF) based on Swarzch-Bayesian Criterion (SBC) and Phillips-Perron (PP) tests. The table reveals that all the variables are I(1) stationary except for *cpi* which is neither I(0) nor I(1) base on ADF test. This applies to both the raw and the normalized data. The level of stationarity of the variables support the use of both Johansen and Autoregressive distributed lag (ARDL) approaches.

Table 3. Unit-Root Test

Regressors	**Augmented Dickey-Fuller**		**P-P Test Statistics**	
	SBC			
	Adj. t-Stat	***Remark***	***Adj. t-Stat***	***Remark***
Raw Data				
cpi			-9.173447*	I(1)
mpr	-7.291393*	I(1)	-11.08864*	I(1)
exr	-8.58519*	I(1)	-8.684986*	I(1)
cps	-7.209584*	I(1)	-8.380398*	I(1)
asi	-8.184243*	I(1)	-8.15897*	I(1)
Normalized Data				
cpi			-4.474515*	I(1)
mpr	-10.76445*	I(1)	-11.08864*	I(1)
exr	-8.41155*	I(1)	-8.353485*	I(1)
cps	-8.681667*	I(1)	-8.359681*	I(1)
asi	-8.846497*	I(1)	-8.855785*	I(1)

Note: ** implies significant at 1.0 per cent'*

Inferential Results

The inferential analyses consider results obtain from both Johansen and ARDL methodologies from the perspectives of both raw and normalized data. The prevalence of the channel of monetary policy transmission mechanism is determined first, based on the magnitude of the coefficients and second, on the information criterion. There seems to be a consensus that the smaller the information criterion the better the model.

Johansen Cointegration Technique

VAR Lag Order Selection Criteria/ Cointegration Tests

As indicated in Table 4 (in Appendix), where the VAR lag order selection criteria for both sets of data are presented, while Hannan-Quinn criterion (HQ) supports optimization at lag 1, Schwarz Information criterion (SC) favors lag 2 and Akaike Information criterion (AIC) opted for lag 4. The VAR model was however run at lag 4 and the model is reported stable as the inverse root of the AR characteristics polynomial is at all lags less than one. Table 9 presents the result of the cointegration tests for both data. The Trace and Max-Eigen value statistics reveal four cointegrating equations at 0.05 critical levels.

Long-Run Coefficients

The long-run equations for raw and normalized data become:

$$cpi = 4.25227 - \frac{0.12240mpr}{[-0.45945]} + \frac{0.219687exr}{[9.34367]} + \frac{0.005226cps}{[21.9764]} + \frac{0.00457asi}{[3.45586]} \quad (16)$$

$R^2 = 0.825$; Adjusted-$R^2 = 0.734$;
AIC = 3.560825; SBC = 4.531265

$$cpi = -0.065347 - \frac{0.003578mpr}{[-0.18218]} + \frac{0.297027exr}{[10.0286]} + \frac{0.476103cps}{[23.9751]} + \frac{0.129432asi}{[4.22098]} \quad (17)$$

$R^2 = 0.829$; Adjusted-$R^2 = 0.743$;
AIC = -7.449547; SBC = -6.489289

Equation (16) presents the result of the raw data while (17) present that of the normalized data. Figures in parenthesis are T-statistics.

From equation (16), it is deduced that interest rate channel yield a negative coefficient but statistically insignificant. Exchange rate, credit and equity channels record statistically significant positive coefficients. This implies that interest rate channel of MPTM is not effective during the review period. Furthermore, exchange rate channel is reported to be the prevalence channel of MPTM, followed by credit channel and then equity channel. From equation (17) which considers the normalized data however, interest rate channel although not statistically significant, returns in line with theory, a negative coefficient. In line with other results, the exchange rate, credit and equity channel yield statistically significant coefficients. Consequently, the result of the normalized data indicates that credit channel outperforms others, followed by exchange rate channel, equity channels and traditional interest rate channel in that order.

As presented in Tables 10 and 11, the short-run dynamics of the vector error correction model (VECM) return statistically significant negative coefficients. This further portrays the cointegration derived from the long-run (Sung-Hoom and Byoung-Ky, 2008). The VAR post estimation diagnostic tests including inverse root of AR characteristics polynomial, residual correlation LM test and white heteroskedasticity test indicate that the models are stable (see appendix for the figure and tables).

Bounds Tests

Table 5 presents results of the bounds tests using both raw and normalized data under ARDL framework. Close examination of the table shows that the F-statistics are 47.3694 and 54.2327 for raw and normalized data, respectively under K=4. At these levels, the F-statistics were above the upper critical bound of 4.37 at 1.0 per cent. This implies that there are cointegrations among the channels of MPTM in both cases.

Table 5. ARDL Bounds Test

	Raw Data	
Test Statistic	***Value***	***K***
F-statistic	47.3694	4
	Normalized Data	
F-statistic	54.2327	4
	Critical Value Bounds	
Significance	***I(0) Bound***	***I(1) Bound***
10.0%	2.20	3.09
5.0%	2.56	3.49
2.5%	2.88	3.87
1.0%	3.29	4.37

Long Run Results

The long-run result presented in Table 6 is divided into two with the upper part showing the results for raw data and the lower part the result for normalized data.

The adjusted R^2 for both raw and normalized data stand at 0.99 each. This implies that the overall models are well-fitted. The Durbin-Watson statistics of 1.908128 for raw data and 1.940253 for normalized data show that there is no evidence of serial correlation.

The long-run coefficients of the channels as reported in Table 6 shows that interest rate channel (*mpr*), in line with theory, yield a negative coefficient but statistically insignificant. Exchange rate, credit and equity channels return positive coefficients and statistically significant.

Whereas equity channel is significant at 10.0 percent, exchange rate and credit channels are both significant at 1.0 percent. For the normalized data, the behavior of the channels seems to mimic that of the raw data except for traditional interest channel which is not only negative but statistically significant.

It is therefore obvious, considering the raw data that the most prevalent channel of monetary policy transmission mechanism is exchange rate, follow by credit channel, equity channel and the traditional interest rate channel. Considering the normalized data however, credit channel occupies the topmost position followed by exchange rate channel, equity channel and the last is the interest rate channel. Two things are common under ARDL methodology; equity channel occupies the third position and interest rate channel comes last in both cases.

Table 6. Long Run Coefficients

Dependent Variable: **CPI**				
		Raw Data		
Selected Model: ARDL(1, 0, 4, 0, 0)				
Variable	***Coefficient***	***Std. Error***	***t-Statistic***	***Prob.***
C	17.176	12.725	1.350	0.180
mpr	-0.549	0.550	-0.998	0.320
exr	0.436	0.102	4.289	0.000
cps	0.008	0.001	7.312	0.000
asi	0.001	0.000	1.869	0.064
R^2= 0.99; Adj.- R2=0.99; AIC =3.735505, SBC=3.960606, HQ=3.826956; Durbin-Watson stat = 1.908128				
		Normalized Data		
Selected Model: ARDL(1, 0, 4, 0, 0)				
C	-0.426	0.114	-3.738	0.000
mpr	-0.102	0.045	-2.236	0.027
exr	0.552	0.098	5.655	0.000
cps	0.787	0.078	10.045	0.000
asi	0.121	0.054	2.243	0.027
R^2= 0.99; Adj.- R2=0.99; AIC =-7.306404, SBC=-7.083589, HQ=-7.215873; Durbin-Watson stat = 1.940253				

Short Run Dynamics

The short-run dynamics otherwise referred to as the error correction model yields statistically significant negative coefficients. This further supports the results obtained from the long-run analysis. More so, it shows the possibility of the restoration of equilibrium in case of distortions. It is however pertinent to mention that the pace of readjustment towards equilibrium is slow in both cases with raw data being slower at -0.057 while normalized data is at -0.073.

Diagnostic Tests

Serial Correlation and Heteroskedasticity Tests

To avoid analyzing spurious regression, a few post-diagnostics tests were conducted. Table 8 presents the results of Breusch-Godfrey Serial Correlation LM Tests and Heteroskedasticity Test based on Breusch-Pagan-Godfrey. The results reveal that both approaches are serial correlation and heteroskedasticity free except for raw data which weakly pass Heteroskedasticity test at 10.0 percent.

Cumulative sums (CUSUM) of residual and cumulative sum of square residual (CUSUMSQ) tests were conducted to assess the stability of the model and of the estimated parameters. The results of the CUSUM and CUSUMSQ as presented in Figures 1 to 4 in the appendix show that the models are largely stable. The instability is reflected in CUSUM towards the end of the study period and at the beginning of the study period for CUSUMSQ.

Model Selection

The study used information criterion and R^2 to determine the best of the models. Literature provides that the model that returns the lowest information criterion or highest R^2 can be adjudged to be the best. In order to take decision, therefore, the study tabulated the information criterion for all models and the associated R^2. As shown in Table 13, Johansen model based on raw data returns the lowest AIC of 3.560825 but the lowest R^2 and adjusted R^2 of 0.82 and 0.73, respectively. Conversely, the SBC was at its lowest for ARDL model implemented using raw data and coincidentally returns the highest R^2 and adjusted R^2 of 0.99 each.

Table 13. Model Selection

Criteria	ARDL Model		Johansen Model	
	Raw Data	Normalized Data	Raw Data	Normalized Data
AIC	3.735505	7.306404	3.560825	-7.449547
SBC	3.960606	7.083589	4.531265	-6.489289
HQC	3.826956	7.215873		
R^2	0.99	0.99	0.82	0.83
Adjusted- R^2	0.99	0.99	0.73	0.74

Considering that the prevalence of the channels of MPTM reported by ARDL and Johansen based on raw data are the same (i.e. exchange rate, credit, equity and interest rate channels in that order). Couple with the fact that the AIC of Johansen based on raw data is lowest, the study favors Johansen based on raw data as the best model.

Consequently, the study concludes that, exchange rate channel is the most prominent channel of MPTM while equity channel is the third. This implies that exchange rate channel is highly critical in determining movement of prices in Nigeria (See Table 14 in Appendix).

5. Conclusions and Policy Options

Using a multi-model approach, the study assesses the channels of monetary policy transmission mechanism in Nigeria to determine the prevalence of asset prices channel with emphasis on equity channel of MPTM. The study applies Johansen and ARDL approaches on raw and normalized data sets from the period 1985Q to 2017Q4. Thus, each technique was run twice; first using raw data and normalized version of the raw data thereby yield four set of regression. Each channel of MPTM was represented by one variable and the choice of the best model was determined by lowest information criterion with emphasis on Akaike Information Criterion. The results return exchange rate channel as the most prevalent while equity channel occupies third position.

On the basis of the findings, the study therefore, suggests close monitoring (and possibly active participation) in the equity market by the monetary authority (CBN). In other to take proactive policy decisions since disruption in the market is likely to affect the economy wide general price level which is the primary mandate of CBN.

For equity channels to realize its full potential, financial market stakeholders (both regulators and operators) should devise products and provide conducive environment that will empower, stimulate and encourage investment opportunities for both local and international investors.

Appendix

Table 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
Raw Data						
1	-2993.237	NA	2.12e+15	49.479	50.054	49.713
2	-2958.449	63.872	1.81e+15*	49.319	50.468*	49.786*
3	-2940.685	31.160	2.05e+15	49.437	50.161	50.138
4	-2927.658	21.784	2.51e+15	49.434*	50.021	50.567
5	-2892.721	55.554	2.16e+15	49.423	52.013	50.638
6	-2873.084	29.617	2.42e+15	49.359	50.006	50.959
7	-2845.962	38.682	2.41e+15	49.324	49.546	51.158
8	-2817.266	38.574*	2.37e+15	49.363	49.060	51.330
Normalised Data						
0	391.613	NA	0.000	-6.236	-6.122	-6.190
1	1356.222	1835.868	0.000	-21.391	-20.70834*	-21.11349*
2	1391.433	64.176	3.00e-16*	-21.555	-20.304	-21.047
3	1413.968	39.254	0.000	-21.576	-19.696	-20.776
4	1427.637	22.709	0.000	-21.593*	-18.945	-20.363
5	1463.215	56.235	0.000	-21.503	-18.547	-20.302
6	1483.769	30.832	0.000	-21.432	-17.906	-20.000
7	1505.743	31.188	0.000	-21.383	-17.289	-19.720
8	1539.323	44.955*	0.000	-21.521	-16.859	-19.627

** indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 7. Short Run Dynamics

Dependent Variable: **CPI**				
Raw Data				
Selected Model: ARDL(1, 0, 4, 0, 0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δmpr	0.027	0.050	0.538	0.592
Δexr	0.014	0.013	1.074	0.285
Δexr(-1)	0.002	0.014	0.151	0.880
Δexr(-2)	-0.032	0.014	-2.307	0.023
Δexr(-3)	-0.037	0.014	-2.663	0.009
Δcps	0.001	0.000	2.317	0.022
Δasi	0.000	0.000	1.590	0.115
ECM(-1)	-0.057	0.004	-15.521	0.000
Normalized Data				
Selected Model: ARDL(1, 0, 4, 0, 0)				
Δmpr	-0.002	0.006	-0.262	0.794
Δexr	0.022	0.018	1.223	0.224
Δexr(-1)	-0.002	0.019	-0.078	0.938
Δexr(-2)	-0.048	0.019	-2.501	0.014
Δexr(-3)	-0.054	0.019	-2.879	0.005
Δcps	0.061	0.025	2.402	0.018
Δasi	0.019	0.010	1.831	0.070
ECM(-1)	-0.073	0.004	-17.041	0.000

Table 8. Serial Correlation and Heteroskedasticity Tests

Raw Data			
Breusch-Godfrey Serial Correlation LM Tests			
F-statistic	0.1988	Prob. F(2,114)	0.8200
Obs*R-squared	0.4378	Prob. Chi-Square(2)	0.8034
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.9148	Prob. F(9,116)	0.0564
Obs*R-squared	16.2979	Prob. Chi-Square(9)	0.0609
Scaled explained SS	22.0658	Prob. Chi-Square(9)	0.0087
Normalized Data			
Breusch-Godfrey Serial Correlation LM Tests			
F-statistic	0.2648	Prob. F(2,116)	0.7678
Obs*R-squared	0.5818	Prob. Chi-Square(2)	0.7476
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.6463	Prob. F(9,118)	0.1099
Obs*R-squared	14.2797	Prob. Chi-Square(9)	0.1127
Scaled explained SS	18.3895	Prob. Chi-Square(9)	0.0309

Table 9. Cointegration Tests

Raw Data				
No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.266	117.262	69.819	0.000
At most 1 *	0.209	79.774	47.856	0.000
At most 2 *	0.193	51.389	29.797	0.000
At most 3 *	0.166	25.505	15.495	0.001
At most 4	0.029	3.521	3.841	0.061
No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.266	37.488	33.877	0.018
At most 1 *	0.209	28.385	27.584	0.039
At most 2 *	0.193	25.884	21.132	0.010
At most 3 *	0.166	21.984	14.265	0.003
At most 4	0.029	3.521	3.841	0.061
Normalized Data				
No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.303	122.293	69.819	0.000
At most 1 *	0.196	77.879	47.856	0.000
At most 2 *	0.191	51.008	29.797	0.000
At most 3 *	0.159	24.915	15.495	0.001
At most 4	0.029	3.612	3.841	0.057
No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.303	44.413	33.877	0.002
At most 1	0.196	26.872	27.584	0.062
At most 2 *	0.191	26.093	21.132	0.009
At most 3 *	0.159	21.302	14.265	0.003
At most 4	0.029	3.612	3.841	0.057

*Both Trace and Max-eigenvalue tests indicates 4 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values*

Table 10. VAR - Short-Run Dynamics (Raw Data)

Variables	Coefficients, Standard errors( ) & t-statistics[ ]	Variables	Coefficients, Standard errors( ) & t-statistics[ ]	Variables	Coefficients, Standard errors( ) & t-statistics[ ]
∆cpi(-1)	0.212561	***∆mpr(-4)***	-0.090787	***∆cps(-3)***	-0.000907
	(0.10353)		(0.07261)		(0.00039)
	[2.05316]		[-1.25026]		[-2.33876]
∆cpi(-2)	0.007778	***∆exr(-1)***	0.010927	***∆cps(-4)***	0.000446
	(0.10431)		(0.01344)		(0.00040)
	[0.07456]		[0.81278]		[1.11098]
∆cpi(-3)	-0.059192	***∆exr(-2)***	0.003104	***∆asi(-1)***	-0.000154
	(0.09870)		(0.01484)		(5.0E-05)
	[-0.59974]		[0.20921]		[-3.06142]
∆cpi(-4)	0.739024	***∆exr(-3)***	-0.008619	***∆asi(-2)***	-0.0000145
	(0.09862)		(0.01510)		(4.7E-05)
	[7.49344]		[-0.57067]		[-0.31049]
∆mpr(-1)	-0.068924	***∆exr(-4)***	-0.001265	***∆asi(-3)***	3.76E-05
	(0.07169)		(0.01572)		(4.8E-05)
	[-0.96139]		[-0.08050]		[0.77729]
∆mpr(-2)	-0.116235	***∆cps(-1)***	0.000210	***∆asi(-4)***	-0.000128
	(0.07007)		(0.00038)		(4.8E-05)
	[-1.65879]		[0.55561]		[-2.65570]
∆mpr(-3)	-0.148484	***∆cps(-2)***	-0.00015	***C***	-0.985079
	(0.07225)		(0.00038)		(0.34316)
	[-2.05506]		[-0.39316]		[-2.87064]
ECM(-1)	-0.151516	**(0.04136)**	[-3.66328]		
R2 = 0.825; Adjusted R2; 0.734; AIC = 3.560825; SBC = 4.531265					

Table 11. VAR - Short-Run Dynamics (Normalized Data)

Variables	Coefficients, Standard errors( ) & t-statistics[ ]	Variables	Coefficients, Standard errors( ) & t-statistics[ ]	Variables	Coefficients, Standard errors( ) & t-statistics[ ]
∆cpi(-1)	0.229026	***∆mpr(-4)***	-0.005978	***∆cps(-3)***	-0.086486
	(0.10353)		(0.00585)		(0.03388)
	[2.21224]		[-1.02221]		[-2.55303]
∆cpi(-2)	0.029320	***∆exr(-1)***	0.017954	***∆cps(-4)***	0.029020
	(0.10382)		(0.01878)		(0.03495)
	[0.28241]		[0.95601]		[0.83032]
∆cpi(-3)	-0.03619	***∆exr(-2)***	0.004947	***∆asi(-1)***	-0.039742
	(0.09912)		(0.02009)		(0.01239)
	[-0.36510]		[0.24630]		[-3.20867]
∆cpi(-4)	0.760227	***∆exr(-3)***	-0.013575	***∆asi(-2)***	-0.002718
	(0.10001)		(0.02044)		(0.01121)
	[7.60122]		[-0.66420]		[-0.24249]
∆mpr(-1)	-0.004646	***∆exr(-4)***	-0.00104	***∆asi(-3)***	0.007136
	(0.00582)		(0.02104)		(0.01211)
	[-0.79786]		[-0.04941]		[0.58921]
∆mpr(-2)	-0.00851	***∆cps(-1)***	0.008671	***∆asi(-4)***	-0.034301
	(0.00567)		(0.03271)		(0.01241)
	[-1.50120]		[0.26506]		[-2.76353]
∆mpr(-3)	-0.010936	***∆cps(-2)***	-0.022036	***C***	0.005117
	(0.00581)		(0.03399)		(0.00145)
	[-1.88208]		[-0.64824]		[3.51665]
ECM(-1)	-0.159113	**(0.04116)**	[-3.86549]		
R2 = 0.829; Adj. R2 =0.743; AIC=-7.449547; SBC = -6.489289					

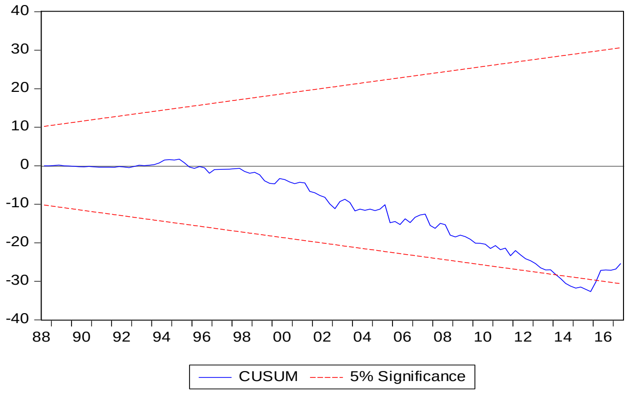

Figure 1. CUSUM of the Raw Data

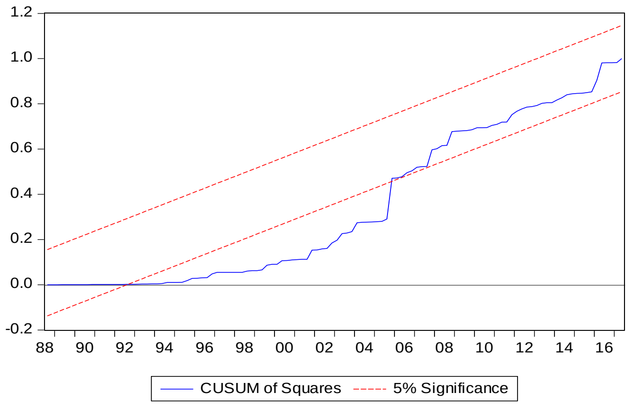

Figure 2. CUSUMSQ of the Raw Data

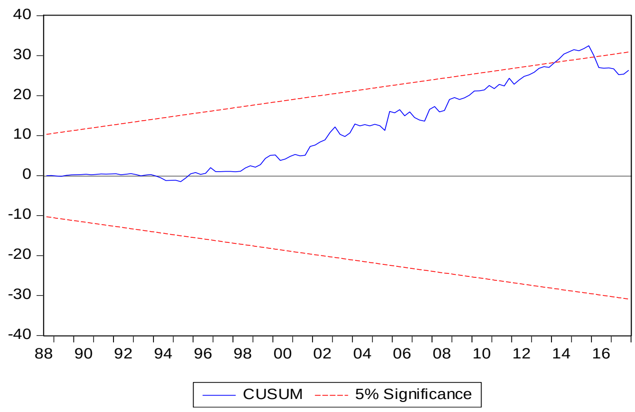

Figure 3. CUSUM of the Normalized Data

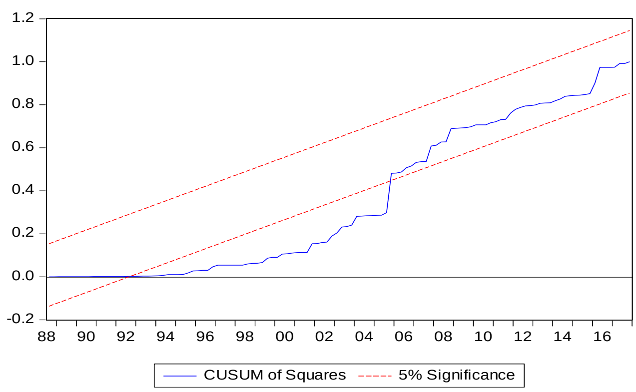

Figure 4. CUSUMSQ of the Normalized Data

Table 14. Prevalence of the Channels of MPTM

Channels	ARDL		Johansen	
	Raw Data	Normalized	Raw Data	Normalized
Interest Rate	4	4	4	4
Exchange Rate	1	2	1	2
Credit	2	1	2	1
Equity	3	3	3	3

REFERENCES

[1] Abaenewe, Z. C. & Ndugbu, M. O. 2012, Analysis of the Effect of Monetary Policy Development on Equity Prices in Nigeria. *West African Journal of Industrial and Academic Research*, 5(1), 140-152.

[2] Adenekan, A. T. & Ahortor, C. R. 2013, An Empirical Investigation into the Monetary Policy Transmission Mechanism in Nigeria. available at https://www.researchgate.net/publication/264001744.

[3] Albert, A. & Modigliani, F. 1963, Life cycle hypothesis of savings: Aggregate implications and tests. An American Economic Review, Vol. 53, 55 – 84.

[4] Bernhard, O. I. 2013, Monetary Transmission Mechanism in Nigeria: A Causality Test. *Mediterranean Journal of Social Sciences*, 4(13), 377-388.

[5] Bungin, S., Reljic, M. & Ivkovic, B. 2015, Estimation of Transmission Mechanism of Monetary Policy in Serbia. *Industrija*, 43(3), 143-158.

[6] Davoodi, H. R., Dixit, S. & Pinter, G. 2013, Monetary Transmission Mechanism in the East African Community: An Empirical Investigation. IMF Working Paper, WP/13/39.

[7] Engle, R. F. & Granger, C. W. J. 1987, Co-integration and Error Correction: Representation, Estimation and Testing. *Econometrica*, 55 (2), 251–276.

[8] Frances, N. O. & Eugene, O. I. 2015, Monetary Policy Transmission Mechanism in Nigeria: A FAVAR Approach. *International Journal of Economics and Finance*, 7(8), 229-237.

[9] Gantnerova, I. S. 2004, Asset Prices in Economic Theory, National Bank of Slovakia. *BIATEC*, Volume XII, 8/2004.

[10] Hung, L. V. 2009, A Vector Autoregression Analysis of the Monetary Transmission Mechanism in Vietnam. *Applied Econometrics and International Development*, 9(1), 165-179.

[11] Hussain, S. I. (2014) Monetary Transmission Mechanism in Pakistan: Credit Channel or Interest Rate Channel, *JISR-MSSE*, (12) 2, 1- 12.

[12] Kapuscinski, M., Kociecki, A., Kowalczyk, H., Lyziak, T., Przystupa, J., Stanislawska, A. & Wrobel, E. 2015, Monetary Policy Transmission Mechanism in Poland. What do we know in 2015? NBP Working Paper No. 249.

[13] Loayza, N. & Hebbel, K. S. 2002, Monetary Policy Functions and Transmission Mechanisms: An Overview, in Monetary Policy: Rules and Transmission Mechanisms. Edited by Norman Loayza and Klaus Schmidtt-Hebbel, Santiago, Chile,

2002, Central Bank of Chile.

[14] Mathias, A. C. 2015, Transmission Mechanism from Money Supply to Inflation in Nigeria. *Economics*, 4(6), *Economics*, 4(6), 98-105.

[15] Mehmet I. Sevin U. & Kemal B. 2015, Transmission Mechanism of Monetary Policy in Nigeria: Evidence from VAR Approach. 1-78.

[16] Mishkin, F.S. 1996, The Channels of Monetary Transmission: Lessons for Monetary Policy. *National Bureau of Economic Research, Working Paper* 5464.

[17] Ndekwu, E.C. 2013, Analysis of the Monetary Policy Transmission Mechanism and the Real Economy in Nigeria. *CBN Occasional Paper*, No. 43, 1-83.

[18] Souza-Sobrinho, N. F. & Minella, A. 2008, The Transmission Mechanisms of Monetary Policy in Brazil. available at www.cemla.org/red/papers2008/ic-04.pdf.

[19] Ngozi, F. O. & Eugene, O. I. 2015, Monetary Policy Transmission Mechanism in Nigeria: A Comparative Analysis. *Research in World Economy*, 93-103.

[20] Nwosa, P. I. & Sabi, M. O. 2012, The Monetary Transmission Mechanism in Nigeria: A Sectorial Output Analysis. *International Journal of Economics and Finance*, 4(1), 204-212.

[21] Onyemachi, M. O. & Lezaasi, L. T. 2012, Monetary Policy and the Transmission Mechanism: Evidence from Nigeria. *International Journal of Economics and Finance*, 4(11), 122-133.

[22] Pesaran, M. H, Shin, Y. & Smith, R. J. 2001, Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*. John Willey and Sons Ltd.

[23] Phillips, P. C. B. & Ouliaris, S. 1990, Asymptotic Properties of Residual Based Tests for Cointegration. *Econometrica*, 58 (1), 165–193.

[24] Philip I. N. & Muibi O. S. 2012, The Monetary Transmission Mechanism in Nigeria: Sectorial Output Analysis *International Journal of Economics and Finance*, 4(1), 204-212.

[25] Sung-Hoon, S. & Byoung-Ky, C. 2008, The Monetary Exchange Rate Model and Stock Prices: using Bound Test Approach. *Journal of Korea Trade,* 12(2), 31-54.

[26] Tobin, J. 1969, A General Equilibrium Approach to Monetary Theory. *Journal of Money, Credit and Banking.* 1(1), 15 – 29.

[27] Williams, C. & Robinson, W. 2014, Evaluating the Transmission Mechanism of Monetary Policy in Jamaica: A Factor-Augmented Vector Autoregressive (FAVAR) Approach with Time Varying Coefficients. *Research and Economic Programming Division*, Bank of Jamaica, pp.1-22.

[28] Yaaba, B.N 2018, Can Financial Conditions Index Serves as an Indicator of Monetary Policy For WAMZ Member Countries? Paper presented at ACRAIA9 in Banjul, the Gambia in July 8, 2018.

[29] Yang, Y., Davies. M., Wang, S., Dunn, J. and Wu, Y. 2011, Monetary Transmission Mechanism in Pacific Island Countries. IMF Working Papers, WP/11/96.

---

i The views expressed herein are solely ours and do not represent or reflect the position of the Central Bank of Nigeria.