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Impact of Financial Deepening on Stock Prices in Nigeria

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1.0 Introduction

Financial system plays an important role in mobilizing savings, promoting information sharing, improving resource allocation and facilitating diversification and risk management (Sahay, et al., 2015). Financial deepening is the provision of liquidity and other financial services in order to increase market participation and productivity. Financial deepening increases flexibility in the financial markets, lowers cost of capital and boosts public and private investments. Financial deepening also has stabilizing effects in an economy by helping to absorb shocks arising from international crises and limiting adverse spillovers (Wang, et al., 2011).

Although, there are different measures of financial deepening, the measures that have consistently appeared in the literature include stock market turnover and liquidity (Rayman & Mustafa, 2015), broad money supply as a ratio of GDP (Nzotta & Okereke, 2009), the ratio of the value of stock traded to GDP and the ratio of market capitalization to GDP (Okoli, 2012), and Credit to private sector as a ratio of GDP.

This paper examines the relationship between financial deepening and stock market performance in Nigeria. Using VAR methodology, it seeks to determine whether there is a causal relationship between stock prices and liquidity, as measured by the ratio of money supply to GDP and the ratio of credit to private sector to GDP. The main contribution of this paper is the use of monthly data as none of the existing empirical studies in this line of research in Nigeria uses data at monthly frequency.

The remainder of this paper is organized as follows: Section 2 reviews some of the related empirical studies. Section 3 describes the data, methods and econometric models. Section 4 reports results and discusses findings and section 5 concludes.

2.0 The Review of Empirical Literature

A considerable number of studies have focused on the relationship between financial deepening and stock market performance both in the advanced and emerging markets. However, the literature on the causal link between the two variables is still growing, especially in emerging markets. As a result, there is little empirical evidence on the causal direction between financial deepening and stock market performance.

Using Pedroni's panel co integration Vector error correction models, Rahman and Mustafa (2015)examines the effects of financial deepening on stock market returns in 19 developed and 21 developing countries over period from 1988 to 2013. Stock market turnover and liquidity are used to proxy financial deepening. The developed countries include Austria, Australia, Belgium, Canada, Denmark, Finland, Ireland, Japan, France, Germany, Netherland, Norway, New Zealand, Portugal, Spain, Sweden, Singapore, UK, USA while the developing countries include Argentina, Bangladesh, Brazil, Chile, Columbia, Egypt, Greece, Indonesia, India, Jamaica, Malaysia, Mexico, Pakistan. Peru, Philippines, Singapore, South Africa, Trinidad, Togo, Thailand and Turkey. The results indicate that stock market turnover has more significant effect on stock market returns than stock market liquidity in both

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selected developed and developing economies, and that developing countries shows more weaker evidence than the developed countries.

In Nigeria, Omole (1999) studies the relationship between financial deepening and stock market development in Nigeria within the framework of multiple regression. The sample covers a period from 1970 to 1994. The study models stock market development to depend on money supply, interest rate and exchange rate. The results show that although, financial deepening is weak in Nigeria given the size of overall economic activities, it however, has capacity to stimulate the development of the stock market

Nzotta and Okereke (2009) examine the relationship between financial deepening and economic growth in Nigeria using two stage least squares technique. They used yearly data for 22 years from 1986 to 2002. They find that the level of financial deepening in Nigeria is low, and that lending rates, financial savings ratio, cheques/GDP ratio and the deposit money banks/GDP ratio have a significant relationship with financial deepening.

Okoli (2012) investigates the relationship between financial deepening and stock market returns and volatility in the Nigerian stock market under GARCH methodological framework. The data used consist of yearly time series of stock market prices, the ratio of the value of stock traded to GDP and the ratio of market capitalization to GDP for the period from 1980 to 2010. The results show that stock market returns is only affected by the ratio of the value of stock traded to GDP.

Recently, Aye (2015) investigates the causal relationship between financial deepening and economic growth in Nigeria using both the standard Granger Causality and a bootstrap modified Granger Causality. The data used consist of yearly time series of money supply as a ratio of nominal GDP and real GDP per capita for a period from 1961 to 2012. The result of the standard Granger Causality shows no causal relationship between the two economic time series. However, the result from the boot strap rolling window shows evidence of a causal direction from financial deepening to economic growth for the periods from 1973 to 1974 and 1970, from economic growth to financial deepening for the periods 1980 to 1982, 1985 to 1986, 1995 to 1996, 1998, 2000, 2004 and 2008 to 2011.

3.0 Methodology

3.1 Data

The data used in this study consist of monthly series of Nigerian stock market All share index (NSE ASI), and two financial deepening variables, namely; M_2/GDP and CPS/GDP. The data are all log-transformed to remove unwanted effects. There are 258 observations covering a period from 1995:01 to 2016:06.However, the two financial deepening variables are converted from their original yearly frequency to monthly frequency to match with the frequency of stock prices data. All data are sourced from Nigerian Central Bank (CBN) database and statistical bulletin, and are analyzed in GRETL and EViews 9 student version. To describe the data, the level data is plotted in figure 1a and the first difference data is plotted in figure 1b.

From figure 1a, we can see that all the variables follow a stochastic trend with fluctuations. However, it appears that the two financial deepening variables co-move in the same stochastic direction, which may suggest that they are both cointegrated. From figure 1b, the three variables show no trending behaviour, with each of them containing some outlying observations which is a feature of most economic time series. This may suggest that the first difference of each of the three series is stationary.

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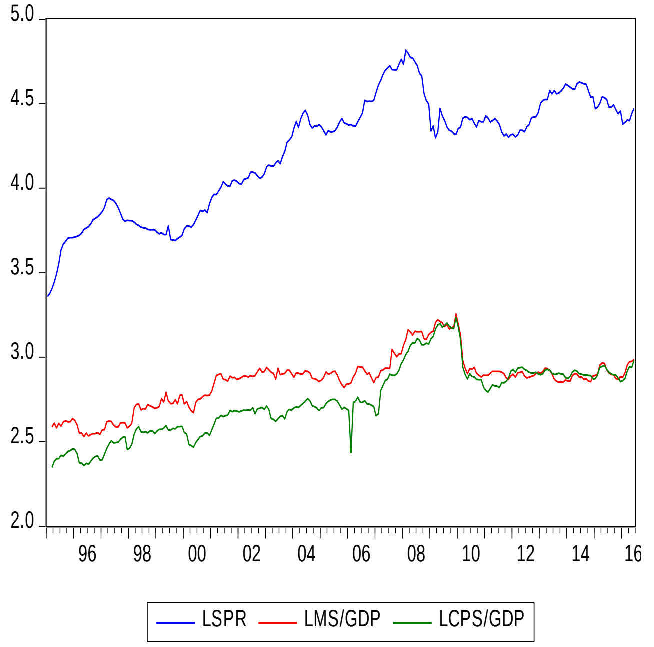

Figure 1a: the plot of the level data for LSPR, LMS/GDP and LCP/GDP

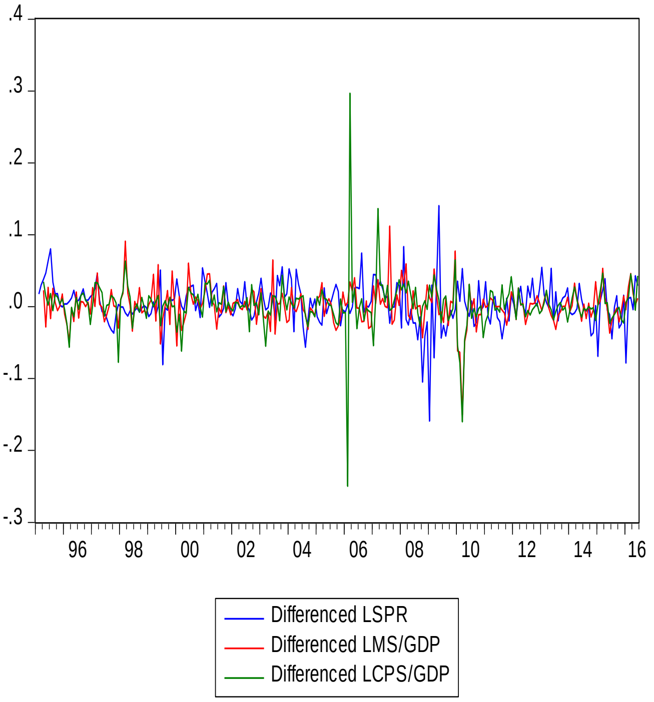

Figure 1b: the plot of the first difference data for LSPR, LMS/GDP and LCP/GDP

3.2 Methods

In this paper, the relationship between financial deepening on stock prices is examined using the Vector Autoregressive dynamic models. This class of models was first proposed by Sims (1980) as an alternative to large scale simultaneous equations models which are plagued with identification problems (Brooks, 2008; Gujarati, 2004). The success VAR models in capturing the dynamic behaviour of most economic and financial time series and in forecasting is well established in the literature.

The reduced form trivariate VAR system incorporating monthly stock prices and two financial deepening macroeconomic variables; money supply as a ratio of GDP and credit to private sector as ratio of GDP, is specified as follows:

$$LSPR_t = \beta_{10} + \beta_{11}LSPR_{t-1} + \beta_{12}LMS\_GDP_{t-1} + \beta_{13}LCPS\_GDP_{t-1} + u_{1t}$$

$$LMS\_GDP_t = \beta_{20} + \beta_{21}LSPR_{t-1} + \beta_{22}LMS\_GDP_{t-1} + \beta_{23}LCPS\_GDP_{t-1} + u_{2t}$$

$$LMS\_GDP_t = \beta_{30} + \beta_{31}LSPR_{t-1} + \beta_{32}LMS\_GDP_{t-1} + \beta_{33}LCPS\_GDP_{t-1} + u_{3t}$$

where u_{it}arestochastic error terms, which represent impulses, innovations or shocks in VAR terminology. The reduced form VAR assumes that all variables in the system are endogenous and there are no contemporaneous terms on the RHS of each equation. The popular OLS technique can effectively estimate each of the above equations.

Economic significance of the estimated VAR coefficients will be examined using the three popular dynamic models; Granger Causality test, Impulse response function (IRF) and Forecast error variance decomposition (FEVD).

4.0 Analysis and Discussion

4.1 Stationarity/Unit root Test

To determine the order of integration for each of our data series, the popular Augmented Dickey-Fuller (ADF) stationarity/unit root test is performed. This test is necessary to ensure that our variables meet the stationarity condition required for hypothesis testing under VAR framework. Here, we run the ADF test on both the level and the first difference data using two test

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equations; (1) an equation that includes only constant and (2) an equation that includes both constant and trend. The Schwarz criterion is used to automatically select the optimum lag lengthfor each series witha maximum of 15 lags being allowed. The results are presented in table 1. For the test in level series, the results are similar for different variables, with the ADF tau statistic failing to reject the null hypothesis of unit root at conventional levels for all the series, except for LSPR series corresponding to the specification that includes only a constant. By contrast, however, the ADF (tau) statistic clearly rejects the null hypothesis of unit root in first difference series at less than 1% level of significance for all series. This is clear evidence that the three series are all integrated of the first order, and thus, there is good motivation to test for cointegration between them.

Table 1: ADF unit root test; p-values in parenthesis

Variable	ADF tau-statistic			
	Level		First difference	
	Constant	Constant& trend	Constant	Constant& trend
LSPR	−2.9569 (0.0405)	−1.9216 (0.6403)	−12.9674 (0.0000)	−13.1497 (0.0000)
LMS/GDP	−1.8302 (0.3653)	−2.0651 (0.5623)	−13.8940 (0.0000)	(−9.8677) (0.0000)
LCPS/GDP	−1.7827 (0.3886)	−2.5007 (0.3277)	−17.0444 (0.0000)	−17.0228 (0.0000)

4.2 Johansen System Cointegration Test

Table 2 presents the results of Johansen system cointegration test for LSPR, LMS/GDP and LCPS/GDP. The Johansen test is a system-based cointegration test that is widely used in the VAR/VECM framework. An evidence of cointegration implies that the three series have long run relationships and a restricted VAR or VECM is appropriate to capture the dynamic relationships between them. Otherwise, an unrestricted VAR is appropriate. The Johansen method uses two test statistics, namely; trace and max eigenvalue statistics. The trace statistic tests the null of r cointegrating relations against the alternative hypothesis of k cointegrating relations, where k is the number of endogenous variables and r = 0, 1, …,k-1. The Max-Eigenvalue statistic tests the null of r cointegrating relations against the alternative hypothesis of r + 1 cointegrating relations. Here, we choose 4 lags and perform the cointegration test using a model that includes intercept and trend. As table 2 reveals, there is no evidence of cointegration among our variables as both the trace and max eigenvalue statistic fail to reject the null hypothesis of no cointegrating relation at conventional levels. Thus, we can proceed to estimate the dynamic relationships of interest using the unrestricted VAR.

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Table 2: Johansen Cointegration test; p-values are in parenthesis

Hypothesized No. of CE(s)	Eigen value	Trace statistic	Max Eigen value statistic
None	0.072068	33.41636 (0.3159)	25.82321 (0.3528)
At most 1	0.045463	15.09114 (0.5670)	11.39954(0.4730)
At most 2	0.014955	3.691597 (0.7862)	3.691597 (0.7862)

4.3 VAR Lag Length Selection

To determine the optimum lag length for our unrestricted VAR specification, we use two information criteria, namely; Akaike information criterion (AIC) and Schwarz information criterion (SC). As it is well known, information criterion selects a lag length that minimizes its value. The results are presented in table 3. As this table shows, AIC select a VAR with 4 lags and SC selects a VAR with 1 lag as indicated by asterisks. Thus, it is our view that a VAR(1) is sufficient to capture the dynamic relationships between the variables of interest.

Table 3: Lag length selection: * indicates selected lag length

Lag	AIC	SC
0	-3.455336	-3.413319
1	-12.893568	-12.725499*
2	-13.013247	-12.719128
3	-13.037478	-12.617308
4	-13.087375*	-12.541154

4.4 Unrestricted VAR Estimation

Table 4 reports the results of the estimated VAR(1) model for LSPR, LMS/GDP and LCPS/GDP data series. The estimation of unrestricted VAR is motivated by the result in section 4.2 that there is no co integrating relations between the variables. We include a constant and one lag of each variable, so there are 4 coefficients in each VAR equation and a total of 12 coefficients in the VAR system. However, our focus is only on LSPR equation since our main objective is to examine the effects of financial deepening on stock prices. The associated p-values of our VAR coefficients are obtained from estimating the system equations using OLS. As we can see from table 4, although, the estimated coefficients are difficult to interpret due to the a theoretical nature of VAR, it however, seems that LSPR(−1) (own effect affect) and LCPS_GDP(−1)are both significantly related to the current stock prices. LMS_GDP(-1) coefficient is not significant.

Table 4: The estimated unrestricted VAR results with p-values in parenthesis

	LSPR	LMS_GDP	LCPS_GDP
LSPR(-1)	0.0398564 (1.53e-208 ***)	0.0152456 (0.0696*)	0.0304130 (0.0062***)
LMS_GDP(-1)	0.0415717 (0.1481)	0.971057 (7.61e-108 ***)	0.0684078 (0.0395**)
LCPS_GDP(-1)	−0.0494219 (0.0419**)	−0.0115203 (0.5272)	0.895255 (6.78e-091 ***)
Constant	0.0398564 (0.2870)	0.0515895 (0.5864)	−0.036891 (0.4310)

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4.4.1 The Inverted AR Root Characteristic Polynomial

Figure 2is a plot of the estimated VAR inverse roots in relation to the unit circle. This helps to determine whether the estimated VAR coefficients are stable. The stability condition, which requires that all characteristic roots lie inside the unit circle, is a pre-condition for the interpretation of VAR coefficients in terms of their economic significance and hypothesis testing. As figure 2 clearly shows, all VAR roots are inside the unit circle, suggesting that our VAR coefficients are stable. This implies that the economic implications of our estimated VAR(1) can be examined using the Granger Causality test, the impact response function (IRF) and the forecast error variance decomposition (FEVD).

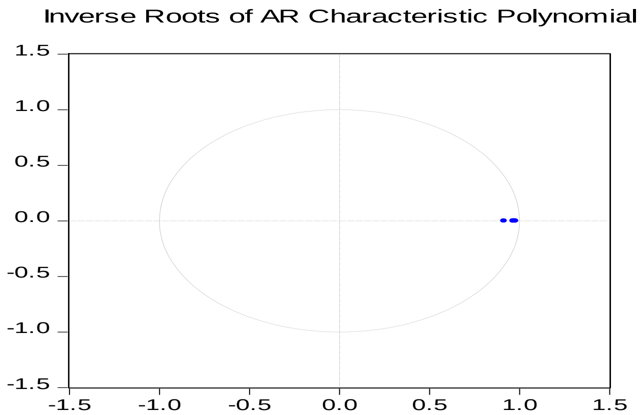

Figure 2: VAR inverse roots in relation to unit circle

4.4.2 Granger Causality/Block Significance Test

Table 5gives the results of the Granger causality/Block significance test. Granger causality testis a block significance F-test which jointly tests the statistical significance of the estimated VAR coefficients by restricting all of the lags of each of LMS_GDP and LCPS_GDP in the*LSPR* equationto zero. The results are largely comparable with those in table 4, with LCPS_GDP coefficient being significant at 5% level in the LSPR equation. This is evidence that changes in credit to private sector has significant impact on stock prices. Further, the LSPR coefficient in the LCPS_GDP equation, which is significant at 1% level, suggests clear evidence of a feedback causal relationships between stock prices and credit to private sector as a ratio of GDP. There is no evidence of causal direction from *L*MS_GDP to *L*SPR (p-value = 0.1468). However, there is weak evidence of causality from *L*SPR to *L*MS_GDP (p-value = 0.0684).

Table 5: Granger causality/Block significance test

Dependent variable *L*SPR		Dependent variable *L*MS_GDP		Dependent variable *L*CPS_GDP	
Excluded	χ^2	Excluded	χ^2	Excluded	χ^2
***L*MS_GDP**	2.104901 (0.1468)	***L*SPR**	3.21184 (0.0684)	***L*SPR**	7.608794 (0.0058)
***L*CPS_GDP**	4.183988 (0.0408)	***L*CPS_GDP**	0.296800 (0.5859)	***L*MS_GDP**	4.283750 (0.0385)
All	4.233138 (0.1204)	All	3.432811 (0.1797)	All	12.68585 (0.0018)

4.4.3 Impulse Response Function

Figure 3diagrammatically shows the impulse responses of LSPR to aone-time shock to *L*SPR (own shock),*L*MS_GDP and *L*CPS_GDP. Again, the results are comparable with those in table 4, with *L*SPR responding positively to own shock and shock to *L*MS_GDP, and negatively to shock to *L*CPS_GDP. Whereas the effects of own shock

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started right from the first month, those of*LMS_GDP* and *LCPS_GDP*started from the second month, and do not die down even after10 months.

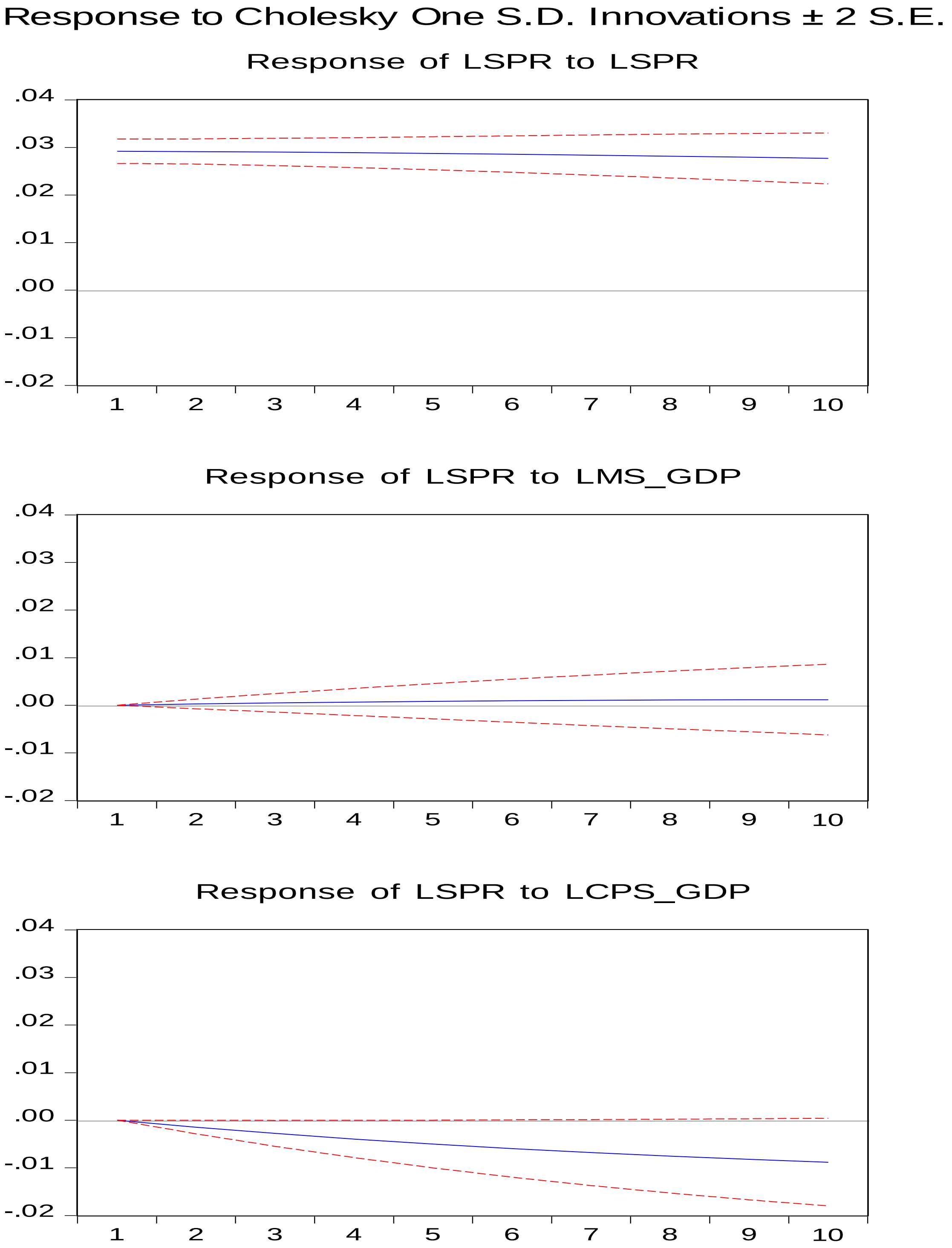

Figure 3: The Impulse response function

4.4.4 Forecast Error Variance Decomposition (FEVD)

Table 6reportsthe decomposition of variance for *L*SPR. As we can see, the major source of variation in *L*SPR is own shock which contributes all the variation in LSPR in the first period, about 98% in the seventh period and approximately 96% in the tenth period. Also, similar to the results reported in the previous sections, the contribution of $LCPS\_GDP$ to the variation in $LSPR$ is substantially higher than that of LMS_GDP.

Table 6: the decomposition of variance for $LSPR$.

Period	Standard error	*LSPR*	*LMS_GDP*	*LCPS_GDP*
1	0.0289714	100.0000	0.0000	0.0000
2	0.040948	99.8712	0.0041	0.1247
3	0.0501393	99.6044	0.0120	0.3837
4	0.057895	99.2319	0.0222	0.7460
5	0.0647346	98.7806	0.0335	1.1859
6	0.0709212	98.2726	0.0452	1.6822
7	0.0766087	97.7258	0.0566	2.2176
8	0.0818953	97.1545	0.0673	2.7782
9	0.0868478	96.5702	0.0771	3.3528
10	0.0915139	95.9817	0.0857	3.9326

5.0 Conclusion

In this paper, we use a trivariate VAR to investigate the impact of financial deepening on stock prices. We use monthly data in logarithmic form from 1995:01 to 2016:06. The financial deepening variables (LMS_GDP and $LCPS\_GDP$) are converted from yearly frequency to monthly frequency in EViews. The main conclusions are as follows:

Although, the Stock prices, MS/GDP and CPS/GDP are all integrated of the first order, the results of Johansen system cointegration test however, indicate no evidence of cointegration or long run relationships between these variables. The number of lags that minimizes the value of information criterion is 1 for Schwarz criterion and 4 for Akaike criterion. When unrestricted VAR(1) is estimated, the coefficients are found to be stable as all VAR roots lie inside the unit circle. The Granger causality test suggest evidence of a bidirectional feedback causality between stock prices and credit to private sector as a ratio of GDP, and weak unidirectional causality from stock prices to money supply as a ratio of GDP. The results suggest that stock prices are positively related to money supply as ratio of GDP but positively related to credit to supply as a ratio of GDP. However, while the effect of credit supply is significant, the effects of money supply is insignificant. Finally, in agreement with several studies, own shocks explain almost all of the error variances in stock prices.

Therefore, if any meaningful changes in the stock market can be induced, the Nigerian monetary authorities should give more serious attention to credit supply instruments than those of money supply, and this should be balanced with other macroeconomic variables in order to achieve the desired policy objectives.

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