

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

# Influence of Stock Prices and Foreign Direct Investment on Nigeria Economy: A VEC Model Approach

Shuaibu Ahmed<sup>1</sup>, Yakubu Musa<sup>2</sup>

Lecturer, Department of Statistics, Kano University of Science and Technology, Wudil, Nigeria<sup>1</sup>

Senior Lecturer, Department of Mathematics, Statistics Unit, Usmanu Danfodiyo University, Sokoto, Nigeria<sup>2</sup>

**ABSTRACT:** This paper analyzes the influence and forecast the innovation variability of stock prices and foreign direct investment on some macroeconomic variables in Nigeria. The vector error correction (VEC) model impulse response and forecast error variance decomposition was employed to forecast the dynamic innovations among the variables. The cointegration relations among the variables were identified by applying Johansen's cointegration tests. The impulse response analysis shows that a shock in stock prices has positive impact on export rate and import rate at initial periods but at long run there are negative effects on all the variables considered although with some lag. Shock to foreign direct investment has positive impact on export rate, import rate and stock price. Also there is positive impact on exchange rate and growth rate at initial periods but at long run there are negative effects but at long run there are negative effects. The result of forecast error variance decomposition analysis reveals that both the stock price and FDI dominated their own innovations, though, this indicates that stock price and foreign investment accounted for contemporary variance from their own innovations, more specifically at initial period.

KEYWORDS: Cointegration, VEC Model, Impulse response, Forecast variance decomposition

### I. INTRODUCTION

Scholars and policy-makers have contributed significantly toward investigating alternative schemes of promoting economic growth. Most of these scholars are of the view that the development of financial system is one of the alternatives that improve the economic growth [1]. The relationship between stock prices and macroeconomic variables has been a subject of debate among researchers due to the facts that stock market has been viewed as a market where most elements that gear the development of a nation's economy are operating with one another [2]. According to [3], for efficient stock market to diversify the domestic fund and activates the productive investment projects, which would lead to the growing economic activities in a country, there must be a significant relationship between the stock market and macroeconomic variables. Evolution of stock market has influence on the operation of banking institutions and hence, on economic promotion. This means that stock market is becoming more crucial, especially in a number of emerging markets and their role should not be ignored [4].

Foreign Direct Investment (FDI) is one of the most important tools which make nations especially the developing ones to achieve the investment levels beyond their levels of saving. In this era, it is almost impossible for every nation to close their boundaries for international trade. The impacts of these factors are multidimensional and they have influences on common man whether they are social, economic, political or cultural. It confers numerous economic benefits to the host countries by providing foreign exchange, innovation, capital, transfer of technology, managerial skills, job expansion and increasing the exports of the country [5]. It augments domestic investment, which is crucial to the attainment of sustained growth and development. FDI has also been argued to act as a catalyst for inward investment by complementing local resources and providing a signal of confidence in investment opportunities [6].



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

#### **II. RELATED LITERATURE REVIEW**

In [7], the authors investigate the response of aggregate industrial output to relative change in prices and exchange rate in Nigeria using Cointegrated VAR methodology. The response of industrial output to a standard deviation shock from change in prices is negative but quite minimal more specifically at initial periods while the response of Industrial output (GDP) to exchange rate innovations is positive more specifically at second year but reduces subsequent to another positive level which continuous even after the tenth year's period. In [8], the economic growth of Nigeria was evaluated in a VEC model and the dynamic correlations of variables have been captured by the analyses of impulse response and variance decomposition. They observed that monetary and fiscal innovations are not all neutral in the short-term or long term; rather, these innovations depend on the policy instruments used.

In [9], the authors investigates and measures the relative impact of Government revenues and expenditure on prices and real GDP in Nigeria. Unrestricted vector autoregressions techniques were employed to analyze and draw policy inferences. Impulse response functions and Forecast error Variance decompositions were compute through 1000 Monte Carlo simulations. The response function shows that both the real GDP and the Prices responded positively to the shocks to government revenue more specifically in the long term but with low magnitude at the short term.

The impact of interest rate and exchange rate to the Stock Return in Pakistan was observed in [10]. A result of multiple regression models indicates that the change in interest rate and exchange rate has a significant impact on stock returns. The change in interest rate gives a negative impact, while change in exchange rate gives a positive to the stock returns.

In [11], the authors examined the effect of macroeconomic variables on stock prices in Ghana. They used cointegration test and Vector Error Correction Model (VECM) to examine both the long-run and short-run dynamic between stock market index and macroeconomic variables and confirmed that there is cointegration between the variables under study which indicated long-run relationship. The impact of stock market development on long-run economic growth in Nigeria was analysed in [12]. The regression result showed that stock market size and turnover ratios are positive in explaining economic growth, while stock market liquidity coefficient was negative in explaining long-run growth in Nigeria.

In [13], the authors observed that the increase of FDI in South Asian countries was in association with the exponential investment by local investors, providing evidence to belief that the relationship between FDI and GDP and the influence of FDI on GDP was negative till the year 1980. The role of macroeconomic variables on foreign direct investment using ordinary least square estimation technique was studied in [14]. The results of analysis indicate that real gross domestic product, interest rate and exchange rate are key determinants of foreign direct investment in Nigeria. This research work is therefore aimed at analysing the dynamic influence and forecast the variability power of stock market and foreign direct investment on some selected macroeconomic variables that stimulate the economic growth in Nigeria.

#### **III. METHODOLOGY**

#### **Model Specification**

Vector Auto-regression (VAR) is a multivariate time series model that has been used primarily to capture the relationship and independencies between important time series variables [15]. In VAR model, every variable in the system is a function of its own lag and the lag of other variables in the system. The General basic model of VAR (p) has the following form

$$y_{t} = \mu + \psi D_{t} + A_{1} y_{t-1} + \dots + A_{n} y_{t-n} + u_{t}$$
<sup>(1)</sup>

where  $y_t$  is the set of *K* time series variables  $y_t = (y_{1t}, ..., y_{Kt})'$ ,  $A_i$ 's are  $(K \times K)$  coefficient matrices,  $\mu$  is vector of deterministic terms,  $D_t$  is a vector of nonstochastic variables such as economic intervention and seasonal dummies and  $u_t = (u_{1t}, ..., u_{Kt})'$  is an unobservable error term. Although the model (1) is general enough to accommodate variables with stochastic trends, it is not the most suitable type of model if interest centres on the cointegration relations. The VECM form



### International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

$$\Delta y_{t} = \Pi y_{t-1} + \Gamma_{1} \Delta y_{t-1} + \dots + \Gamma_{p-1} \Delta y_{t-p+1} + \mu + \psi D_{t} + u_{t}$$
(2)  
$$\Pi = \sum_{i=1}^{p} A_{i} - I \quad \text{and} \quad \Gamma_{i} = -(A_{i+1} + \dots + A_{p})$$

In the VECM model, attention focuses on the  $(n \times r)$  matrix of cointegrating vectors  $\beta$ , which quantify the "longrun" relationships between variables in the system, and the  $(n \times r)$  matrix of error-correction adjustment coefficients  $\alpha$ , which load deviations from the equilibrium (*i.e.*  $\Pi y_{t-1}$ ) to  $\Delta y_t$  for correction. The  $\Gamma_i$  coefficients in (2) estimate the short-run effects of shocks on  $\Delta y_t$ , and therefore allow the short-run and long-run responses to differ.

The term  $\prod y_{t-1}$  is the only one that includes I(1) variables. Hence,  $\prod y_{t-1}$  must also be I(0). Thus, it contains the cointegrating relations. The  $\Gamma_{jS}$  (j = 1, ..., p - 1) are often referred to as the short-run or short-term parameters, and  $\prod y_{t-1}$  is sometimes called the long-run or long-term part.

#### **Impulse Response Analysis**

Impulse response analysis is a standard tool that tracks the impact of one variable on other variables in the system. It is an essential tool in empirical causal analysis and policy effectiveness analysis. If the VAR (p) process  $y_t$  is I(0), it has a Wold moving average (MA) representation of the form

$$y_{t} = A_{1}y_{t-1} + \dots + A_{p}y_{t-p} + \varepsilon_{t}$$

$$= \Phi(B)\varepsilon_{t} = \sum_{i=0}^{\infty} \Phi_{i}\varepsilon_{t-i}$$

$$I = (I - A_{1}B - A_{2}B - \dots - A_{p}B^{p})\Phi(B)$$
(3)

Where the deterministic terms are ignored to simplify the exposition. In this representation,  $\Phi_0 = I_k$  and the  $\Phi_j^{,s} = (j = 1, 2, ...,)$  are (k x k) coefficient matrices. The marginal response of  $y_{n,t+j}$  to a unit change in  $y_{mt}$ , holding all past values of  $y_t$ , are given by the (n, m)th elements of the matrices  $\Phi_j$ , view as a function of j. more precisely, the element of  $\Phi_j$  represent response to  $u_t$  innovations, that is, to forecast errors therefore these quantities are sometimes called forecast error impulse response [16].

#### **Forecast Error Variance Decomposition**

Variance decomposition or forecast error variance decomposition indicate the amount of information each variable contributes to the other variable in the model. Variance decomposition determine how much of the forecast error variance of each of each variable can be explained by endogenous shock to the other variables.

The h-step forecast error for the  $y_t$  variables in terms of structural innovation  $\varepsilon_t = (\varepsilon_{1t}, \dots, \varepsilon_{kt})^{T} = B^{-1}e_t$  can be shown to be

$$y_{T+h} - y_{T+h/T} = \psi_0 \varepsilon_{T+h} + \psi_1 \varepsilon_{T+h-1} + \dots + \psi_{h-1} \varepsilon_{T+1}$$
(4)

From this expression, kth component of the forecast error vector is

$$\delta_k^2(h) = \sum_{j=0}^{h=1} \left( \psi_{k1,j}^2 + \dots + \psi_{kK,j}^2 \right) = \sum_{j=1}^k \left( \psi_{kj,0}^2 + \dots + \psi_{kj,h-1}^2 \right)$$

Copyright to IJIRSET



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

Where  $\psi_{nm,j}$  denote the (n,m)th elements of  $\psi_j$ , the quantity  $\left(\psi_{kj,0}^2 + \dots + \psi_{kj,h-1}^2\right)$  is interpreted as the contribution *jth* innovation to the h-step forecast error variance of k. this interpretation is justified if the  $\varepsilon_t$  can be view as shock in variable n. the relative contributions obtained as the ratios  $\left(\psi_{kj,0}^2 + \dots + \psi_{kj,h1}^2\right) / \delta_k^2(h) = w_{kj}(h)$ . The corresponding estimated quantities are often reported for various

variables and forecast horizon.

### **IV. RESULTS AND DISCUSSION**

Quarterly time series data for Real GDP, Foreign Direct Investment (FDI), Exchange rates USD/NGN (ER), Export rate (EXP), Import rate (IMP) and stock price index of the Nigerian Stock Exchange (NSE) were used in this research paper. The Data were obtained from Statistics Department of the Central Bank of Nigeria (CBN).

Table 1								
	Augmented D	Vickey-Fuller test	Phillips-Perron Test Statistic					
Variables	sta	atistic						
	Null Hypothesi	s: Variable is Non	Null Hypothesis: Variable is Non					
	stat	ionary	sta	stationary				
	Level	First Difference	Level	First Difference				
SPI	-1.9163	-6.0959	-1.9423	-6.1030				
EXP	2.7077 -8.2904		-1.4763	-8.1900				
GDP	2.2847 -3.9313		1.1607	-14.8333				
FDI	-2.3648 -12.7410		-2.2446	-17.4229				
IMP	4.6152 -6.3915		-1.4812	-8.4657				
ER	-0.2149 -8.9272		2.76621	-8.9292				
Test Critical values								
5%	-2	.8887	-2.8889					
10%	-2	.5813	-2.5815					

The variables are non-stationary at level but become stationary at the first differencing.

Table 2								
Hypotl	nesized Trace	0.05Cri	itical Prob	. Max-Ei	gen (	0.05 Critical	Prob.	
	No of CE(s)	Statistics	Value	S	Statistics	Value		
None	257.327	95.754	0.000	99.1	77	40.078	0.000	
At most 1	158.150	69.8	190.000	75.282		33.877	0.000	
At most 2	82.868	47	.8560.000	61.820		27.584	0.000	
At most 3	21.048	29.7	970.355	13.207		21.132	0.433	
At a	most 4	7.842 15.49	05 0.483	7.812	14.265	0.	398	
At most	5 0.02	9 3.841 0.	864 0.	029	3.	841	0.864	

Table 2 the results for both Trace statistic and Max-Eigen statistic indicated that there are three co-integrating vectors, so we can say there is a long-run equilibrium relationship among the variables.



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

### Website: www.ijirset.com

#### Vol. 6, Issue 7, July 2017

Table 3								
SPI	ER GDP EXP FDI							
1.00000	-878.1755	-2.2421	0.0063	-0.1787	-0.0926			
S.E	(159.6772)	(0.34981)	(0.01844)	(0.01574)	(0.02835)			

From co integrating test, it was determined that the rank of cointegration matrix to be equal to one. Consequently, the cointegrating vector is given by

 $\beta = (1, -878.1755 - 2.2421 + 0.0063 - 0.1787 - 0.0926)$ 

The values correspond to the cointegrating coefficients of stock price (normalized to one), ER, GDP, EXP, FDI and IMP respectively. Thus, the vector above can be expressed as follows:

SPI = 878.1755ER + 2.2421GDP - 0.0063EXP + 0.1787FDI - 0.0926IMP(5)

From equation 5, it shows that the stock price is positively related with ER, GDP and FDI and negatively related to EXP and IMP.

Table 4								
FDI ER GDP EXP SPI I								
1.00000	4914.241	-12.5470	-0.0354	-5.5960	0.5182			
S.E	903.260	1.94669	0.11895	1.31674	0.16386			

The cointegrating vector is given by

 $\beta = (1, +4914.241 - 12.5470 - 0.0354 - 5.5960 + 0.5182)$ 

The values correspond to the cointegrating coefficient of FDI (normalized to one), ER, GDP, EXP, SPI and IMP respectively. The vector above can be expressed as follows:

FDI = -4914.241 + 12.5470 + 0.0354 + 5.5960 - 0.5182

It shows that FDI is positively related to GDP, EXP, SPI and negatively related to ER and IMP.

### **VEC Model Impulse Responses Analysis**

The graph line trace out the impulse response functions. The x-axis gives the time horizon or the duration of the shock while the y-axis gives the direction and intensity of impulse.







# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

### Website: www.ijirset.com

#### Vol. 6, Issue 7, July 2017

Fig 1 above indicates that ER initially responded negatively to SPI shocks in the first quarter, but later rose to positive in the second quarter and declined to negative shocks in the long run. There is negative and positive fluctuation of GDP and EXP to SPI shocks. The response of FDI to SPI shocks was initially negative. It rose to positive with no effect in the second quarter, slowdown to negative in the third quarter and then fluctuates around negative. The response of IMP to SPI shocks was initially positive, but later slowdown to negative and fluctuates around in the long-run.





Fig 2 above indicates that there is positive response from ER to the shock in FDI at first period. But decrease to negative and fluctuates in the long run. The shock of FDI to GDP is fluctuating around positive and negative. The response of EXP to the shock in FDI is fluctuating around positive sign. There is negative response from SPI from period one but steady increase from negative to positive response throughout the period under consideration. The response IMP is fluctuating around the positive sign.

#### **VEC Model Forecast Error Variance Decomposition**

Forecast variance error decomposition determines how much of the forecast error variance of each of the variables can be explained by endogenous shock to the other variables.



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

### Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

				Table 5			
Period	S.E.	SPI	ER	GDP	EXP	FDI	IMP
1	0.097410	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.120307	92.16351	0.904122	1.527333	1.075832	3.250917	1.078290
3	0.135807	81.80981	1.298830	1.749552	1.093683	12.98356	1.064560
4	0.149547	81.64568	1.115325	1.468177	0.975297	13.04727	1.748244
5	0.162177	82.43442	1.090050	1.291244	1.086356	12.55553	1.542405
6	0.173561	82.72605	0.978364	1.328621	1.056359	12.51172	1.398885
7	0.183516	82.88418	0.875429	1.199122	0.987889	12.70099	1.352398
8	0.193465	82.60386	0.790108	1.124226	1.016182	13.13425	1.331369
9	0.202942	82.63135	0.718974	1.036814	1.005229	13.29259	1.315049
10	0.212176	82.66241	0.658591	1.054006	0.999741	13.32394	1.301315

From Table 5 above, SPI dominated its own innovations with more than 80 per cent of the variance of its forecast. The innovation of FDI 13.31 per cent, with less contribution from others variables. This implies that SPI accounted for its contemporary variance from its own innovation.

Table 6

				14010 0			
Period	S.E.	FDI	ER	GDP	EXP01	SPI	IMP
1	0.789689	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.814144	99.18129	0.346656	0.369300	0.006616	0.029147	0.066987
3	0.891603	82.84193	1.710676	0.393685	4.181799	0.478408	10.39350
4	0.922152	77.58993	2.666984	0.401527	4.088945	0.448856	14.80376
5	0.942148	74.66999	3.854425	0.402434	4.683876	0.530897	15.85838
6	0.965816	73.18577	3.889141	0.387482	4.516467	0.577318	17.44382
7	0.978180	71.53787	4.297614	0.377778	4.799726	0.595503	18.39151
8	1.001816	68.61135	4.880671	0.368544	5.153724	0.674107	20.31160
9	1.019515	66.41042	5.248309	0.356068	5.408385	0.692304	21.88451
10	1.037680	64.38626	5.707159	0.354112	5.592146	0.730122	23.23020

From Table 6 above, FDI dominate its own innovations with more than 60 per cent of the variance of its forecast. The innovation in ER and EXP less than 6. IMP contributes 0.00 to 23.23 per cent. This indicates that FDI accounted for its contemporary variance from its own innovations.

#### **V. CONCLUSION**

This paper considered the vector error correction (VEC) model impulse response and forecast error variance decomposition to analyse the influence and forecast the variability innovations among the study variables.

The impulse response analysis shows that a shock in stock prices has positive impact on export rate and import rate at initial periods but at long run there are negative effects on all the variables, although with some positive fluctuations. Shock to foreign direct investment has positive impact on export rate, import rate and stock price. There are positive impact on exchange rate and growth rate at initial periods but at long run there are negative effects. The result of forecast error variance decomposition analysis reveals that Stock price index (SPI) dominated its own innovations with 81.65 to 100 per cent of the variance of its forecast. Although the contribution varies, foreign direct investment caused most contributions at long run to stock price then GDP, IMP, ER and EXP. On the other hand, FDI dominate its own innovations with 64.39 to 100 per cent of the variance of its forecast. This indicates that FDI accounted for its contemporary variance from its own innovations. There is a little variation cause by import rate in the letter period.



# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

#### Website: <u>www.ijirset.com</u>

#### Vol. 6, Issue 7, July 2017

In view of the above, it is also recommended that appropriate monetary measures shall be adopted by monetary managers to control inflation, in order to make stock market less volatile. Government should focus on economic policies like attracting foreign direct investment by bringing betterment in law and order situation and attractive investment opportunities for foreigners.

#### REFERENCES

- [1] Darrat, A. F.. "Are Financial Deepining and Economic Growth Causality Related? Another look at the Evidence", *International Economic Journal*, Vol. 13, No. 3, 1999
- [2] Oseni I.O. and Nwosa P.I. "Stock Market Volatility and Macroeconomic Variables Volatility in Nigeria: An Exponential GARCH Approach". Journal of Economic and Sustainable Development. Vol. 2, No. 10, Pp.43-53, 2011
- [3] Muhammad M.H., Muhammad A., Nosheen R., Maleeha F. and Maryam M., "The Impact of Macroeconomic Variables on Stock Prices: An Empirical Analysis of Karachi Stock Exchange". Mediterranean Journal of Social Sciences, Vol. 3(3), Pp. 295-312, 2012
- Kahn M, Sendahji A, "Financial development and economic growth: An overview", IMF Working Paper, WP/00/209, International Monetary Fund. 2000.
- [5] Javed, K., Falak, S., Awan, R., and Ashfaq, M. "Foreign Direct Investment, Trade and Economic Growth: A Comparison of Selected South Asian Countries," International *Journal of Humanities and Social Science*, *2*(5), 2012
- [6] Agosin, M. and Mayer, R. "Foreign Investment in Developing Countries: Does it Crowd in Domestic Investment?" UNCTAD Paper, No.146, 2000

[7] Musa, Y. and Jibrin A. sanusi, "Industrial Output Response to Inflation and Exchange Rate in Nigeria: An Empirical Analysis". Journal of Economics and Sustainable Development. Vol.4(20):74-81, 2013

[8] Musa, Y., Asare, B. K., and Gulumbe, S.U.. "Effect of Monetary-Fiscal Policies Interaction on Price and output Growth in Nigeria". CBN Journal of Applied Statistics. Vol. 4(1): 55-75, 2013

[9] Musa, Y. and Asare, B.K., "Long and Short run relationship analysis of monetary and Fiscal policy on Economic growth in Nigeria: A VEC Model Approach". *Research Journal of Applied Sciences, Engineering and Technology. Vol.* 5(10): 3044-3051, 2013

[10] Ahmed, M.A., Rehman, R.U., Raoof, A. "Do interest rate, Exchange Rates effect Stock Returns? A Pakistani Perspective", International Research Journal of Finance and Economics (50), pp. 146-150, 2010

- [11] Kwame M., Kwaku S. and Kwasi P. "Effect of Macroeconomic factors on Stock Prices in Ghana: A Vector Error Correction Model Approach". International Journal of Academic Research in Accounting, Finance and Management Science, Vol. 3, No. 2 Pp. 32-43, 2013
- [12] Augustine, U. and Salami Otaru P. "Stock Market Development and Economic Growth: Evidence from Nigeria". European Journal of Economics, Finance and Administrative Science. Pp 44-53, 2010
- [13] Agrawal, P. "Economic Impact of Foreign Direct Investment in South Asia", Indra Gandhi Institute of Development Research, 2000.
- [14] Harrison, O. O. "Do Domestic Macroeconomic Variables Matter for Foreign Direct Investment Inflow in Nigeria?" Research Journal of Finance and Accounting ISSN 2222-1697 (Paper) ISSN 2222-2847 (Online) Vol 3, No 9, Pp. 55-67, 2012
- [15] Saadia U. and Frederick A.A.S., "Testing Granger Causality with application to Exchange rates for Swedish Kronor with GB pound and US dollar". Master Thesis, submitted to the Department of Statistics, School of Economics and Management, Lund University, 2009.
- [16] Lutkepohl H., (2005), "New Introduction to Multiple Time Series". Springer-Verlag, Berlin.