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Article *in* International Journal of Economics and Business Research · January 2014

DOI: 10.1504/IJEBR.2014.064670

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Exchange rate volatility and sectoral analysis of foreign direct investment inflows in Nigeria (1970–2009)

Lukman O. Oyelami*

Wesley University of Science and Technology,
Ondo, P.M.B 507 Ondo State Nigeria
E-mail: oyelamilukman@yahoo.com
*Corresponding author

Dauda O. Yinusa

Department of Economics,
Obafemiawolowo University,
Ile Ife, Osun State, Nigeria
E-mail: yinusaolalekan@yahoo.com

Abstract: This paper investigates the effect of exchange rate volatility on oil and non-oil FDI inflows in Nigeria using vector error correction model (VECM) for the period 1970–2009. Previous theoretical and empirical studies on this issue produced conflicting results. The empirical results from short run dynamics show that bi-directional causal relationship exists between exchange rate volatility and non-oil FDI and no causal relationship exists between exchange rate volatility and oil FDI. But the results from forecast error variance decomposition (FEVD) indicate that there is no significant differential effect of exchange rate volatility on oil and non-oil FDI in Nigeria. This might suggests that there are other variables that drive oil FDI inflows apart from macroeconomic condition in Nigeria.

Keywords: volatility; autoregression; decomposition; causality; Nigeria.

Reference to this paper should be made as follows: Oyelami, L.O. and Yinusa, D.O. (2014) 'Exchange rate volatility and sectoral analysis of foreign direct investment inflows in Nigeria (1970–2009)', *Int. J. Economics and Business Research*, Vol. 8, No. 3, pp.296–308.

Biographical notes: Lukman O. Oyelami is currently a PhD student at the Department of Economics, Obafemi Awolowo University, Ile-Ife.

Dauda O. Yinusa is a Senior Lecturer in the Department of Economics, Obafemi Awolowo University, Ile-Ife.

1 Introduction

Foreign direct investment (FDI) is an international flow of capital that provides a parent company or multinational organisation with control over foreign affiliates. There are several definitions of FDI in the literature. It refers to investments in businesses of another country, which may take the form of either 'Greenfield' investment (also called 'mortar and brick' investment) or merger and acquisition. This entails the acquisition of existing assets rather than new investment. FDI comprises not only merger, takeover/acquisition and new investment, but also reinvested earnings and loans and similar capital transfers between parent companies and affiliates.

FDI over the years has been identified as a veritable tool for economic growth especially in the developing countries. This has been established by several studies, (Akinlo, 2004). Also, UNCTAD expected global inflows of FDI to reach more than $1.2 trillion in 2010, rise further to $1.3–1.5 trillion in 2011 and head forwards $1.6–2 trillion in 2012, with more than half of these flows received by businesses within developing countries (2010 world investment report by United Nations). By implication, FDI is increasingly becoming an indispensable instrument of economic growth.

As a result of the crucial nature of FDI to economic growth via technological transfer and capital accumulation, countries of the world especially the developing economies are scrambling to improve their level of competitiveness. This is an effort to attract more FDI into the key sectors of their economies. Base on this, extensive investigation is required as to determine factors that can influence the flow of FDI both in the short run and long run. Some factors identified in the literature include: degree of openness, market size, infrastructural provision, interest rate, expected returns and purchasing power of the host country. While all these factors highlighted might influence the long term trend of the flow of FDI depending on the peculiarity of the host country. It has been established that FDI flow swings around long term trend in different recipient countries (Froot and Stein, 1991; Kiyota and Urata, 2004). As result of this, serious considerations must be given to other factors that could influence this swing, if a comprehensive policy of FDI is to be formulated.

Out of all the probable factors, exchange rate movement and its volatility have been seriously considered in the literature (Frankel and Froot, 1987; Dominguez, 1986). According to Linda Goldberge (2006) "One of the many influences on FDI activity is the behavior of exchange rates". Exchange rates defined as the domestic currency price of a foreign currency, matter both in terms of their levels and their volatility. Exchange rates can influence both the total amount of FDI that take place and the allocation of this investment spending across a range of countries". Also, several empirical studies have corroborated this assertion but with conflicting conclusion. (Cushman, 1985; Aizenman, 1992).

According to UNCTAD Investment Report 2010 on Nigeria, Nigeria is one of the SSA countries that have attracted the most FDI targeted at the region. The inflows of FDI to the country have been very high compared to most other countries in the region.

Between 1970 and 2009 the country has attracted more than $63 billion of FDI with the bulk of it going to oil and gas sector of the economy. In spite of the high and rising inflow of FDI into the Nigerian economy giving the population of the country, Nigeria is underperforming in FDI attraction within Africa. In the first half of the 1990s, per capita FDI inflows were higher in Nigeria than in any other African country, with the exception of Angola and Equatorial Guinea. Thereafter, other African countries began to catch up. In the most recent period (2001–2007), the average per capita FDI inflow to other large African countries and other oil producers in the continent all exceeded those to Nigeria. This indicates that Nigeria is not sharing fully the growing non-oil FDI to the continent.

From the foregoing, it is clear that sectoral distribution of FDI in Nigeria is highly skewed in favour of oil sector which has been described as an enclave of the economy and thereby limiting the contributions of FDI to economic growth. Therefore, any study that will be relevant for policy formulation on FDI must take into cognisance the relative importance of oil and non-oil FDI in Nigeria. There is an expansive literature indicating that real exchange rate volatility has a direct, deleterious effect on FDI inflows (see, for instance, Bénassy-Quéré et al., 2001; Kiyota and Urata, 2004). Exchange rate volatility generates air of uncertainty as the variance of expected profits rises and its net present value falls. This could cause investors to hesitate about committing significant resources to FDI, thus serving as a serious disincentive for FDI inflow. As a result of this, there is need to investigate how the exchange rate movement and its volatility affect the inflows of FDI to oil and non-oil sector of the Nigerian economy with a view to determining the deferential effect of the variables on oil and non-oil FDI in Nigeria.

In Nigeria, the following factors have been identified across studies: trade openness, past FDI, domestic interest rates (a proxy for rate of return on investment), market size, infrastructural availability, exchange rate movement and its volatility as crucial to the determination of the size of the aggregate FDI in the country. Some of studies surveyed include (Akinkugbe, 2003; Alaba, 2003; Ogunleye, 2008). Out of all these studies, only Alaba (2003) attended to the effect of exchange volatility on FDI in manufacturing and agricultural sector with the conclusion that the volatility in official exchange rate is not significant for FDI in the two sectors, though volatility in the parallel market is significant.

Generally, most studies on determinants of FDI in Nigeria make use of ordinary least square technique of estimation which is predicated on the assumption that FDI is a dependent variable being determined by some macroeconomic variables. However, this may not be true as there could be bi-directional causality between FDI and these macroeconomic variables thus introducing endogenous bias into most of these studies. Specifically, Alaba (2003) estimated the relationship between FDI and exchange rate volatility within the context of OLS despite the overwhelming evidence that as exchange rate volatility causes FDI, FDI could as well causes exchange rate volatility thus making two variables endogenous. Also, the study down played the importance of other non-oil sectors with emphasis on manufacturing and agricultural alone.

Given the fact that empirical research on FDI and exchange rate uncertainty highlighted ambiguous effect of exchange rate volatility on FDI base on the motive of MNCs. Lin et al. (2003) establish that the way exchange rate volatility would affect a market seeking FDI is different from the way it affects an export substituting FDI or resource seeking FDI. While it has a negative impact on market seeking MNCs, the effect on export substituting MNCs is positive and that of resource seeking MNCs which oil FDI seems to be still remain an empirical issues. The implication of this is that exchange rate movement and volatility might affect FDI into different sectors of the economy differently depending on the motive of MNCs.

Given the fact that the bulk of FDI into the Nigerian economy is concentrated on the oil sector, it is crucial and timely to identify those factors that are capable of influencing non-oil FDI and oil FDI separately in the country both in the short run and long run if the full benefit of FDI is to be achieved. Also, due to endogenous relationship that exit between the two variables (exchange rate volatility and FDI) which has been established at aggregate level by Ogunleye (2008), a method of analysis with an inbuilt capacity to address the problem of endogeneity raised earlier was used.

The questions that then arise are: does exchange rate volatility affect oil and non-oil sectors of the Nigerian economy the same way? Are the traditional factors hitherto identified to attract FDI in Nigeria still relevant when FDI is disaggregated into oil and non-oil sectors? What is the direction of causation between exchange rate volatility and sectoral FDI?

2 Theoretical framework

The main focus of this paper is to examine the differential effect of exchange rate volatility on sectoral FDI. The existing theoretical papers linking the two variables together follow two different approaches. On one hand, the flexibility of long-run production which suggests a positive relationship between the two variables. On the other hand, a second string of papers put forward by Bénassy-Quéré et al. (2001), Cushman (1985) and Goldberg and Kolstad (1995) criticised the assumption of production flexibility and consider risk-aversion in the short-run with no possibility of adjusting the productive factors after the shock is realised thus suggesting negative relationship between exchange rate volatility and FDI.

This study is based on risk aversion theory because of the short term nature of data employed thus assume that firms are unlikely to adjust factors of production in the short run. Different model have emerged from risk aversion theory base on different assumptions but irrespective of the assumption underlining the model, MNCs simply want to maximise utility from profit subject to various constraints out of which exchange rate volatility is crucial. Specifically, this work follows that of Alexander (2006) in model specification with slight modification .The need for modification arose because of the data challenges.

3 Model specification

The study employed vector autoregression (VAR) methodology to study the effect of the exchange rate volatility on sectoral FDI in Nigeria. Two models are specified, one for each sector. The model specification is of the form:

$$x_t = \begin{pmatrix} (+) & (+) & (+) & (-) & (+) \\ \text{INFR}, & \text{PGDP}, & \text{EX}', & \text{RVOL}, & \text{FDI}_1 \end{pmatrix},$$

$$x_t = \begin{pmatrix} (+) & (+) & (+) & (-) & + \\ \text{INFR}, & \text{PGDP}, & \text{EX}', & \text{RVOL}, & \text{FDI}_2 \end{pmatrix},$$

All variables are expressed in logarithms apart from infrastructural availability proxy by power generation. INFR is used to capture infrastructural availability. This is an important variable in the model because of the cost implication of infrastructural availability on the production activities of MNCs. PGDP is the per capita gross domestic product and it is a measure of market size and growth in the host country. Market size and growth have been identified in the literature as a strong determinant of FDI in African countries (Ajayi, 2003). Also, EX, represents change in the level of real effective exchange rate. This measure was used instead of ordinary real exchange rate because it has been weighted by the level of trade and investment between each country and the rest of the world and it is a more appropriate measure of countries' competiveness (Kiyota and Urata, 2004). RVOL is the real exchange rate volatility and it was generated using generalised autoregressive heteroscedasticity model (GARCH). FDI is the foreign direct investment which was disaggregated into two sectors FDI_1 for non-oil FDI and FDI_2, for oil FDI which was introduced into the second model in equation (5) subsequently along with the same set of variables.

4 Ordering of variables for the VAR

The variables are ordered as follow in order to make them consistent with the objectives of the study. (INFR, PGDP, EX, RVOL, FDI)'. Based on the efficient markets arguments of Gordon and Veitch (1989), financial variables are placed after PGDP in the ordering and also the relative exogeneity was taking into consideration. That is, EX and RVOL, which are financial variables, come after non-financial variables such as PGDP and INFR. Also, since PGDP can be influenced by available infrastructure, it is appropriate for INFR to come after PGDP. The ordering of financial variables Ex and RVOL also follows the same procedure. More importantly, FDI is placed last in the ordering as to allow contemporary shocks to other variables to influence it and not vice versa

5 Time series properties of data

Before carrying out any meaningful econometric analysis, it is imperative to test the variables for a unit root (non-stationarity). In this regard, augmented Dickey Fuller unit root test (Dickey and Fuller, 1981) with intercept alone and trend and intercept were carried out on the variables and they were all integrated of order one I(1),that is they were stationary at first difference.

Table 1 Unit root test

Variables	*Unit root test*						*Likely degree of integration*
	ADF			*PP*			
With intercept only	*Level*	*1st diff.*	*2nd diff.*	*Level*	*1st diff.*	*2nd diff.*	
INFR.	–3.2884**	–6.5759*	-	–4.7470*	–6.5604*	-	l(0)
PRGDP	–1.7723	–5.0925*	-	–1.7507	–5.8197*	-	l(1)
EX.	0.1249	–5.0231*	-	0.0081	–5.0161*	-	l(1)
EVOL	–0.9640	–5.4371*	-	–0.8363	–11.2975*	-	l(1)
FDI_1	–0.6262	–6.7435*	-	–0.6332	–6.8594*	-	l(1)
FDI_2	–0.7463	–6.5119*	-	–0.6578	–6.5769*	-	l(1)
With intercept and trend							
INFR.	–1.6948	–8.0559*	-	–1.5181	–8.0855*	-	l(1)
PRGDP	–2.0696	–9.8425*	-	–2.0009	–5.8939*	-	l(1)
EX	–2.1626	–4.9952*	-	–2.2558	–4.9909*	-	l(1)
RVOL	–3.2701**	–5.3558*	-	–3.4736**	–10.9784*	-	l(0)
FDI_1	–2.6987	–6.6595*	-	–2.8837	–6.6984*	-	l(1)
FDI_2	–2.1195	–6.4318*	-	–2.2047	–6.5182*	-	l(1)

ADF test for unit root is a standard first pass at determining whether a given data series is trend stationary or not but with Perron (1989) criticism of this test in the presence of structural break that the ADF test may incorrectly fail to reject the null hypothesis of a unit root if there is a big break in the series. In view of this, both augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests were employed to avoid spurious regression. The results from both ADF and Phillips-Perron show that all the variables are stationary at first difference excerpt for exchange rate volatility and infrastructure that are stationary at level in ADF and Philips-Perron unit root test.

Having established the stationarity of the variables at first difference, Johansen cointegration test was performed to determine whether there is at least one linear combination of these variables that is I(0). To avoid autocorrelation, variables in the model were divided into two along nonoil and oil FDI dichotomy for cointegration test and model estimation.

Table 2(a) Co-intergration results

No. of CE(s)		*Trace*	*0.05*	
	Eigenvalue	*Statistic*	*Critical value*	*Prob.***
None *	0.630395	80.83837	69.81889	0.0051
At most 1	0.465211	43.01616	47.85613	0.1322
At most 2	0.304710	19.23259	29.79707	0.4763
At most 3	0.105264	5.422419	15.49471	0.7624
At most 4	0.030978	1.195788	3.841466	0.2742

Notes: Series: INFRA RGDP1 EX VOL NoilFDI (FDI_1)
*Denotes rejection of the hypothesis at the 0.05 level
Trace test indicates 1cointegrating eqn(s) at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 2(b) Cointergration results

No. of CE(s)		*Trace*	*0.05*	
	Eigenvalue	*Statistic*	*Critical value*	*Prob.***
None *	0.665511	70.52811	69.81889	0.0438
At most 1	0.401645	32.19785	47.85613	0.6012
At most 2	0.252370	14.22287	29.79707	0.8279
At most 3	0.081889	4.043228	15.49471	0.9000
At most 4	0.029635	1.052915	3.841466	0.3048

Notes: Series: INFRA RGDP1 EX VOL oil, FDI (FDI_2)
*Denotes rejection of the hypothesis at the 0.05 level
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
**MacKinnon-Haug-Michelis (1999) *p*-values

Table 3 Optimal lag length selection

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	–1,875.481	NA	7.55e+41	110.6165	110.8410	110.6931
1	–1,750.422	205.9801	2.14e+39	104.7307	106.0775	105.1900
2	–1,726.025	33.00696*	2.45e+39	104.7662	107.2353*	105.6082
3	–1,705.417	21.82007	4.21e+39	105.0245	108.6160	106.2493
4	–1,660.712	34.18675	2.49e+39	103.8654	108.5791	105.4729
5	–1,605.606	25.93211	1.70e+39*	102.0945*	107.9305	104.0847*
Endogenous variables: INFR RGDP EX VOL FDI_2						
Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	–1,875.472	NA	7.54e+41	110.6160	110.8405	110.6926
1	–1,750.446	205.9257	2.14e+39	104.7321	106.0789	105.1914
2	–1,726.064	32.98737*	2.46e+39	104.7685	107.2376*	105.6105
3	–1,705.416	21.86210	4.21e+39	105.0245	108.6159	106.2493
4	–1,660.808	34.11194	2.50e+39	103.8711	108.5848	105.4786
5	–1,605.766	25.90224	1.72e+39*	102.1039*	107.9400	104.0942*

Note: *Indicate selected optimal lag length

In Table 2, five variables were introduced for cointegration analysis, namely (INFR, PRGDP, EX, VOL and FDI_1) and the results reject the assumption of no cointegration and indicate one cointegration equations at (5%) level of significance. Similarly, in Table 3 the second group of variables was introduced with the substitution of oil FDI (FDI_2) for non-oil FDI (FDI_1). The result indicates one cointegrating equation equally.

6 Optimal lag length selection

The theoretical exposition of VAR methodology is based on the implicit assumption that the lag order is known (Hamilton, 1994). Empirically however, the optimal lag order is typically unknown and hence it must be determined Yinusa and Akinlo (2008). Table 3 presents the result of lag selection for each of the group of variables we estimated.

From Table 2 the first group of variables which comprises of infrastructural availability (INFR), per capital real gross domestic product (PGDP), exchange rate movement (EX) exchange rate volatility and non-oil FDI (FDI_1) were tested for optimal lag length and the result predicts two different optimal lag lengths. They are optimal lag length of two based on LR test statistic and Schwarz information criterion while final prediction error, Akaike information criterion and Hannan-Quinn information criterion predict optimal lag length of five. To resolve this, test of stability was conducted on the two predicted optimal lag lengths and the result shows that only the predicted optimal lag length of two proved stable for model estimation. Also in Table 3 the second group of variables which comprises of infrastructural availability (INFR), per capital real gross domestic product (PGDP), exchange rate movement, exchange rate volatility (EX) and oil FDI (FDI_2) were also tested and the result indicates optimal lag length of two and five. Stability test was also conducted to determine the stability or otherwise of the two predicted lag length and optimal lag length of two proved stable.

7 Model estimation

Sequel to the cointegration results obtained in Table 2 and 3 which indicate one cointegrating equation in the two models, the next task was to determine whether to estimate VAR in first difference or a VECM in levels. With cointegration between two or more of l(1) variables, VAR models in first difference are misspecified (Hamilton, 1994). Thus an application of VECM would be a more appropriate method of estimation to the level of the cointegrated series. As a result of this, VECM was estimated and the results are presented in Table 4.

Table 4 and Table 5 present the result of two different models estimated to determine causality between non-oil FDI (FDI_1) and other variables in one hand and oil FDI (FDI_2) and other variables on the other hand. Short run component of the VECM provides information on causality of the variables which is line with the objective three of the study and according to Granger (1969) if a variable or a group of variables is found to be helpful for predicting another variable or a group of variables then such variable(s) is said to Granger cause the other variables(s), otherwise it fails to Granger cause the other variables. Particularly within the framework of VAR, a variable fails to Granger cause

other variable(s) if all the coefficients of the lagged value of such variable are zero in the equation of the other variable(s).

In Table 4, the results show that while we can accept hypothesis that per capita gross domestic product (PRGDP) and exchange rate movement (EX) do not Granger cause non-oil FDI (FDI_1) similar hypothesis is rejected for infrastructural availability at 10% significant level and exchange rate volatility at 5% significant level. The result in Table 4 also indicates that the hypothesis that non-oil FDI (FDl_1) does not Granger cause infrastructural availability (INFRA) and exchange rate volatility can be rejected at 5% significant level. This implies that bi-direction causality runs between non-oil FDI (FDI_1) and exchange rate volatility while one way causality runs from non-oil FDI (FDI_1) to infrastructural availability (INFRA).

Table 4 Vector error correction estimation results

Error correction:	*D(INFRA)*	*D(PRGDP)*	*D(EXCH)*	*D(VOL1)*	*D(Noil.FDI1)*
CointEq1	–0.519824	1.08E-06	–2.46E-09	–1.54E-06	–6.11E-12
	[–3.65522]	[1.24818]	[–1.62702]	[–3.69257]	[–0.57059]
D(INFRA(-1))	0.137771	3.82E-07	*–3.14E-09**	1.26E-07	–7.41E-12
	[0.69240]	[0.31598]	*[–1.48658]*	[0.21449]	[–0.49471]
D(INFRA(-2))	0.142278	8.01E-08	–2.71E-09	–3.54E-07	*2.12E-11**
	[0.75523]	[0.07010]	[–1.35375]	[–0.63908]	*[1.69250]*
D(PRGDP(-1))	–13990.79	*0.268519**	–0.000178	0.106357	–1.18E-06
	[–0.45646]	*[1.44363]*	[–0.54719]	[1.18001]	[–0.51235]
D(PRGDP(-2))	–15015.27	–0.096910	–0.000218	–0.099031	1.33E-06
	[–0.47134]	[–0.50129]	[–0.64293]	[–1.05714]	[0.55586]
D(EXCH(-1))	*–49001708***	48.81047	–0.136601	*–109.5763**	–6.00E-05
	[–2.20815]	[0.36245]	[–0.57941]	*[–1.67916]*	[–0.03590]
D(EXCH(-2))	–27557684	*201.5722**	–0.204816	*–97.33345**	–0.001708
	[–1.26750]	*[1.52776]*	[–0.88672]	*[–1.52239]*	[–1.04319]
D(VOL1(-1))	–72333.44	0.095396	0.000763	*–0.571900****	*8.11E-06***
	[–1.17706]	[0.25580]	[1.16802]	*[–3.16474]*	*[1.75158]*
D(VOL1(-2))	*–108589.9***	–0.007919	0.000567	0.205858	*7.92E-06*
	[–1.76320]	[–0.02119]	[0.86635]	[1.13668]	*[1.70871]***
D(RFDI1(-1))	*5.97E+09***	–12523.03	25.30539	*15457.14***	–0.095769
	[2.13887]	[–0.73914]	[0.85315]	*[1.88271]*	[–0.45550]
D(RFDI1(-2))	1.23E+09	20575.55	5.508911	*15341.29***	0.086205
	[0.46792]	[1.29278]	[0.19771]	*[1.98917]*	[0.43647]
C	6.43E+08	306.9270	9.148115	775.9925	–0.010768
	[2.13609]	[0.16808]	[2.86166]	[0.87697]	[–0.47520]
R-squared	0.450762	0.263148	0.247516	0.831841	0.329582
Adj. R-squared	0.209097	–0.061067	–0.083577	0.757851	0.034599

Note: (1) t-statistics are in [ ]. (2) ***, **and *denote the level of significance at 1%, 5% and 10%, respectively.
INFRA RGDP1 EX VOL NOILFDI (FDI_1)

Table 5 Vector error correction estimation results

Error correction:	*D(INFRA)*	*D(PRGDP)*	*D(EXCH)*	*D(VOL)*	*D(Oil.FDI2)*
CointEq1	–0.499304	–7.57E-07	–1.76E-09	–4.52E-07	–2.05E-11
	[–4.87417]	[–1.12324]	[–1.32701]	[–1.07060]	[–0.91993]
D(INFRA(-1))	–0.323311	6.53E-07	–5.50E-09	–7.20E-07	–1.26E-11
	[–1.75207]	[0.53794]	[–2.30684]	[–0.94615]	[–0.31430]
D(INFRA(-2))	0.148646	–1.64E-08	–2.73E-09	–3.43E-07	1.24E-11
	[0.87300]	[–0.01468]	[–1.24085]	[–0.48789]	[0.33290]
D(PRGDP(-1))	–16888.71	0.122821	–0.000149	0.184915	–3.98E-06
	[–0.60878]	[0.67328]	[–0.41664]	[1.61565]	[–0.65837]
D(PRGDP(-2))	13,140.47	–0.028059	–0.000172	–0.021133	4.43E-06
	[0.45597]	[–0.14807]	[–0.46338]	[–0.17775]	[0.70560]
D(EXCH(-1))	–70179071	–127.8609	–0.155019	–26.57154	–0.002073
	[–3.31645]	[–0.91889]	[–0.56719]	[–0.30437]	[–0.44937]
D(EXCH(-2))	–63482893	–11.21633	–0.277822	–41.68820	–0.003341
	[–2.69645]	[–0.07245]	[–0.91365]	[–0.42920]	[–0.65089]
D(VOL1(-1))	284,399.1	0.090521	0.002378	–0.294289	2.53E-05
	[2.83706]	[0.13732]	[1.83659]	[–0.71159]	[1.15820]
D(VOL1(-2))	117826.5	–0.321550	0.001698	0.502228	1.09E-05
	[1.56296]	[–0.64865]	[1.74405]	[1.61480]	[0.66607]
D(RFDI2(-1))	9.42E+09	10,829.64	40.21374	3789.550	0.268129
	[3.89813]	[0.68174]	[1.28885]	[0.38023]	[0.50913]
D(RFDI2(-2))	4.81E+09	–15174.02	29.39804	3933.072	0.419384
	[2.52875]	[–1.21407]	[1.19752]	[0.50157]	[1.01213]
C	1.53E+09	2481.421	12.91665	629.8996	–0.020933
	[3.82871]	[0.94237]	[2.49742]	[0.38128]	[–0.23979]
R-squared	0.619438	0.399059	0.236205	0.767468	0.220437
Adj. R-squared	0.420096	0.084281	–0.163878	0.645665	–0.187906

Notes: INFRA RGDP1 EX VOL OILFDI (FDI_2)

In Table 5 the results show that we can accept hypothesis that infrastructural availability (INFR), per capita gross domestic product exchange rate movement (EX) and exchange rate volatility (VOL) fail to granger cause oil FDI (FDI). The result also shows that causality runs from oil FDI (FDI_1) to per capita real gross domestic product at 5% level of significance.

Table 6 Variance decomposition of Noil.FDI$_1$

Variance decomposition of Noil.FDI$_1$						
Period	*S.E.*	*INFRA*	*PRGDP*	*EXCH*	*VOL*	*Noil.FDI$_1$*
1	0.094173	0.402692	0.469071	0.364761	10.89904	87.86443
3	0.145960	2.554896	4.805901	4.371457	4.621016	83.64673
6	0.203966	1.811159	19.87874	3.821411	2.430437	72.05826
7	0.219071	1.731271	23.02074	3.318548	2.163556	69.76589
10	0.263677	2.378058	29.25083	2.494390	1.857240	64.01948
Cholesky ordering: INFRA PRGDP EXCH VOL1 RFDI1						

Table 7 Variance decomposition of Noil.FDI$_1$

Variance decomposition of Oil.FDI2						
Period	*S.E.*	*INFRA*	*PRGDP*	*EXCH*	*VOL1*	*Oil.FDI2*
1	0.245778	2.365421	0.619399	1.048483	8.110131	87.85657
3	0.380082	2.339741	0.744961	1.029759	5.113071	90.77247
6	0.476297	5.049959	0.575208	1.415286	4.698202	88.26135
9	0.566781	6.565229	0.495522	1.825091	4.033262	87.08090
10	0.599093	6.204858	0.561338	1.655617	3.662627	87.91556
Cholesky ordering: INFRA PRGDP EXCH VOL1 FDI2						

From Table 6, the results show that apart from non-oil FDI 'own' shock; shock to exchange rate volatility is the most important source of forecast error variance in the first quarter. It accounts for 10.9% of the forecast error variance in non-oil FDI but the influence declines in the longer horizons and reduce to just 1.9% in the tenth quarter. Also, variable like exchange rate movement, infrastructural availability and per capita real gross domestic product account for a negligible percentage of forecast error variance in non-oil FDI. They contribute 0.36%, 0.40% and 0.44% respectively. In the third quarter, both exchange rate movement and infrastructural availability reach the peak of 4.6% and 2.5% respectively and starts declining in the longer horizons but infrastructural availability demonstrates tendency to bounce back in the tenth quarter. However, from the sixth quarter to last quarter per capita real gross domestic product (proxy for market size) becomes the major source of forecast error variance in nonoil FDI reaching the peak of 29.3% in tenth quarter.

From Table 7 the results show that exchange rate volatility dominates the forecast error variance of oil FDI in the first and second quarter unlike what obtains in non-oil FDI where it only dominates in the first quarter. It accounts for 8.1% of the forecast error variance in oil FDI in the first quarter but starts declining afterwards. This stresses the fact that exchange rate volatility will only reduce FDI in the short run as multinational companies will device mechanisms to reduce the impact in the long term. Exchange rate movement and per capita real gross domestic product account for negligible portion of oil FDI forecast error variance throughout the periods. While exchange rate movement barely contributes more than 1%, per capita real gross domestic product accounts for less than 1% all through. However, infrastructural availability serves as a major source of forecast error variance in oil FDI in the longer horizons starting from the sixth quarter.

9 Conclusions and policy implication

The short run dynamic in VECM revealed that there is bi-directional causality between exchange rate volatility and non-oil FDI while no causality exits between exchange rate volatility and oil FDI. It then implies that while exchange rate volatility influences non-oil FDI there is also a feedback effect from non-oil FDI to exchange rate volatility thus making the two variables endogenous but this is not the case for oil FDI and exchange rate volatility. This might be an indication that oil FDI inflows are not principally driven by domestic macroeconomic variables.

There is no important differential effect of exchange rate volatility on oil and non-oil FDI as the results from FEVD revealed that exchange rate volatility only exerts strong influence on the two variables in short term and gradually fades away in the longer horizons but the influence is more on non-oil FDI. This finding is in line with production flexibility argument advanced by Frankel and Froot (1987).

As FDI determining factor, exchange rate volatility seems to be more important than exchange rate movement.

10 Policy implication

With the use of vector autoregression model, the study empirically established that exchange rate volatility does not have important differential effect on sectoral FDI (non-oil FDI and oil FDI) in Nigeria as the two variables respond negatively to shock in exchange volatility. However, some determinants of FDI are sector specific such as infrastructural provision and market size proxy by RGDP per capita .While infrastructural provision is crucial for oil FDI, market size is more important for non-oil FDI. Thus, any empirical treatment of FDI at aggregate level may not provide adequate information required for the formulation of appropriate policies by government in her drive for FDI attraction.

Base on this, government is advised to see each sector of the economy as being unique not only on how exchange rate volatility affects FDI attraction in each sector but other determinants of FDI, thus for a comprehensive policy to be formulated such policy must be mixed and targeted to attracting FDI in sectors where the impact will be most felt by the economy.

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