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Oil Price Volatility and Equity Valuation of Listed Energy Companies in Nigeria: A Panel ARDL Model

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ABSTRACT

The study investigates the nexus between oil price volatility and market valuation of listed energy companies in Nigeria, within a dynamic heterogeneous panel model framework. The paper utilizes the pooled mean group estimator in analysing the hypothesized relationship among equity valuation of listed energy companies in Nigeria, oil price volatility, and two control variables – firm profitability and inflation rate. The overwhelming weight of the evidence emerging from key findings of the study indicates that a distinct difference exists between the short-run impact of oil price volatility on the equity valuation of oil firms in Nigeria from the long-run impacts. While the short-run results show a mix of negative and positive, but statistically significant impacts of oil price volatility on equity valuation across listed oil firms, the long-run results indicate a statistically significant positive impact of oil price volatility on the stock valuation of energy firms in Nigeria. The short-run results are highly suggestive of the important role of the level of risk investors are willing to accommodate in their decisions to invest in stocks under different economic scenarios, in explaining stock returns for each of the oil-producing firms in Nigeria. The paper concludes that the risk premium investors place on stocks of oil companies is central in explaining the short-run impact of oil price volatility on the equity valuation of oil firms in Nigeria.

Keywords: Oil Price Volatility, Equity Valuation, Energy Companies, Panel ARDL Model, Pooled Mean Group
JEL Classifications: Q41, E44 , Q40, C23

1. INTRODUCTION

Crude oil price plays a significant role in every economy of the world. This reality is particularly true for the Nigerian economy both at the supply and demand sides. Nigeria is a net-oil exporting country, and the country is largely dependent on imported refined petroleum products to satisfy domestic demand. Unexpected fluctuations in the prices of crude oil therefore have diverse ramifications for the economy including the potential to disrupt economic activities in the country. Oil price fluctuations in recent years have been quite remarkable, and there appears to be a corresponding movement in stock market prices. Major global events such as the Arab Springs, the Syrian war, the Covid-19 pandemic, and the ongoing Russian war on Ukraine, have either been accompanied by a surge or a plunge in oil prices, thereby further complicating an already difficult situation for most economies across the globe. For example, the Covid-19 pandemic, and the ongoing Russian war on Ukraine have mounted unprecedented supply chain disruptions on economies, and a resultant severe economic pressure on businesses and households. An undeniable collateral-effect of these shock-inducing events have also been largely reflected in the emerging general trend of stock prices of listed energy companies in the Nigerian stock exchange, which no doubt presents an opportunity of empirical value and interest to this study.

Expectedly, there has been a growing interest in both the theoretical and empirical relationship between crude oil prices and stock markets performance, and this further underscore the role of crude oil to the global economy via its effect on business financial resources and incomes (Badeeb and Lean, 2018). Unfortunately, there appears to be a measure of ambiguity in the literature on the relationship between oil price dynamics and stock price changes (Bjørnland, 2009). Of specific interest to this study is the question of whether crude oil price changes drive the valuation of listed energy companies in an oil producing and exporting economy. This question for now, remains an open question within the extant literature. In any case, the answer to this central question may not only be complex but should have an inter-temporal connotation, making it of significant interest to investors, policymakers, researchers, and other stakeholders over the years.

Available statistics on monthly crude oil prices obtained from the Organization of Petroleum Exporting Countries (OPEC), show that when crude oil prices over the period (2012-2020) was most volatile, value of stocks of listed energy companies in the Nigerian stock exchange appears to decrease during the same periods. As can be seen in Figure 1, when crude oil prices were relatively most volatile in September 2012, market capitalisation of listed energy firms in Nigeria took a deep. At about March 2015, oil prices were most volatile, again market capitalisation of listed energy firms in Nigeria recorded a sharp decline. Similar pattern can be observed for January 2017 and January 2019. For other periods when oil prices were least volatile, again market capitalisation of listed energy firms in Nigeria appeared to rebound or recovered significantly. These data pattern is highly suggestive of a strong negative correlation between crude oil price volatility and market capitalisation of listed energy firms in Nigeria. What remains to be seen is whether this observed relationship can be substantiated statistically and if substantiated, whether this observed pattern is the same over the short and long run periods.

The key questions emanating from the assumed relationship observed from the available statistics are, how much of the perturbations in stock value of energy companies listed in the Nigerian stock market can be linked to fluctuations in oil prices? In addition, do prices of crude oil significantly drive equity prices of listed energy companies in Nigeria in the same direction or in the opposite direction? At the firm level, are listed energy companies in Nigeria strikingly insulated or noticeably exposed to shocks in prices of crude oil in the short run?

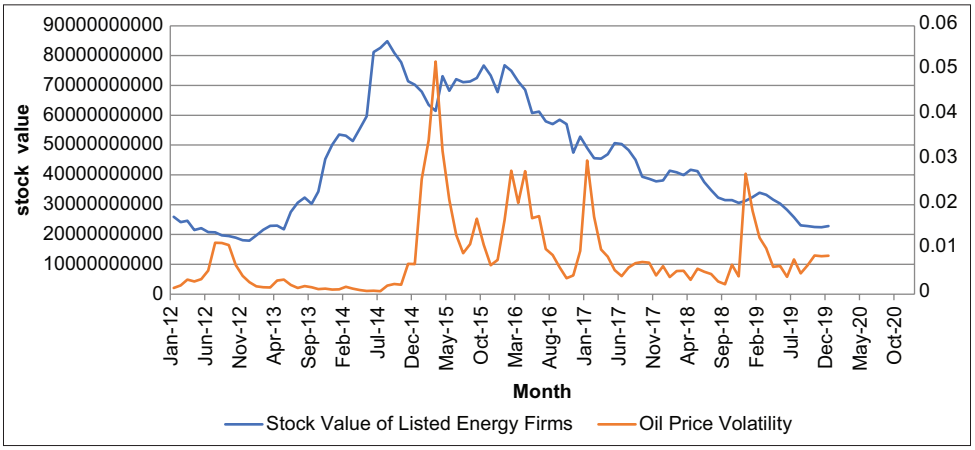
The study investigates the nexus between oil price volatility and market valuation of listed energy companies in Nigeria, within a dynamic heterogeneous panel model framework. Specifically, the study does not only separate the long run impact of the relationship from the short run dimension, but it also examines the short run firm level dimension of the hypothesized relationship. By accounting for the firm level short-run dimension of the relationship among oil companies in Nigeria, this paper stands out from previous related studies in this area of inquiry. In what follows, we present the section on a review of the related literature, the empirical data and methodological approach to the study, results and discussion of key findings, and some concluding remarks.

2. LITERATURE REVIEW

Theoretically, crude oil prices will impact differently on equity prices of firms depending on whether such firm is an oil producer or consumer. The transmission channel from prices of crude oil to equity prices will also have consequences for the expected outcomes. Degiannakis et al. (2018), highlight some of the leading theoretical perspectives that attempt an explanation of the relationship between prices of crude oil and stock markets.

Through the stock valuation channel, oil prices have a direct impact on stock markets. This of course will be contingent on whether a company is an oil producer or consumer, variations in the price of oil can affect its future cash flows positively or negatively (Alamgir and Amin, 2021). Since oil is one of the most critical production variables for a company that consumes oil, an increase in the prices of crude oil will result in higher production costs. This assumes that there are no consequences of perfect substitution among the

Figure 1: Oil price volatility and listed energy firm stock value in Nigeria



Source: Authors computation based on data from OPEC and Nigerian Stock Exchange (NSE)

production elements, which would diminish profit margins and, consequently, future cash flows. A rise in oil prices, on the other hand, will boost an oil producer's predicted cash flows because it will increase profit margins (Degiannakis et al. 2018). It is predicted in this case that oil producers will behave bullish during periods of rising oil prices, while oil consumers will be bearish.

Oil prices may also follow the monetary channel to affect future cash flow discount rates. The discount rate is influenced by expected inflation and actual interest rates. Oil price variations affect stock returns through inflation and interest rates. Oil prices increase production expenses (Charfeddine, Klein, & Walther, 2020). As producers pass on these costs to consumers, inflation will rise due to higher retail prices. Assuming the monetary authorities do not raise short-term interest rates in response to rising inflation. Rising short-term rates will first boost commercial borrowing rates, thereby raising firms' borrowing costs (Bergmann, 2019). Higher borrowing costs will also result in fewer positive NPV projects due to lower cash flows. Rising discount rates or falling cash flows will in turn lower stock prices. The severity of the repercussions depends on how well the central bank controls inflation. Assuming a competent central bank, inflation expectations should remain steady despite an increase in the prices of crude oil, staying near to the inflation target (Adegboyega, 2021).

Crude oil prices may also affect equity prices through the output channel. Rising oil prices tend to reduce consumers' discretionary income due to changes in retail pricing resulting from higher production costs as well as rising gasoline and heating oil expenses (Dagher and El Hariri, 2013). Reduced income reduces expenditures and overall output, hence further reducing labor demand. In other words, rising oil prices will worsen the terms of trade for an economy that imports oil, resulting in a decline in income and a negative wealth effect on expenditure, so reducing aggregate demand. Typically, such findings have a negative impact on the stock market for economies that import crude oil. In contrast, an oil-exporting economy will experience a positive income impact as oil revenues increase, leading to stronger aggregate demand and, ultimately, increased output. A positive shift in aggregate demand will only occur if the income advantage can outweigh the production cost effect (Baumeister et al. 2018). In this scenario, increased output will boost predicted cash flows for businesses operating inside the economy, which will be viewed favorably by the stock market.

There is also the fiscal channel which has a unique effect on oil-exporting nations as the proceeds from oil sales are used to finance core infrastructure. Oil price hikes frequently result in a transference of income from oil-importing to oil-exporting economies, allowing for higher government spending. If government purchases and domestic spending are viewed as complementary, domestic consumption will expand. In such a setting, it is anticipated that private companies will enhance their cash flows and, consequently, their profitability (Yildirim and Arifli, 2021). As a result of these developments, stock prices will climb, and the stock market will begin a bullish phase. If consumption and government spending are viewed as alternatives, crowding-out effects will have the reverse effect. Due to the substitution effect, the most productive private capital will exit the market, which will have a negative impact on stock markets. (Olayungbo, 2021).

Finally, the uncertainty channel also has a role to play in explaining the relationship between oil prices and equity valuation of firms. This channel is no doubt the pinnacle of transmission channels and should be used whenever possible. The rising cost of oil is the primary factor contributing to the increased levels of uncertainty that are currently being experienced within the actual economy. This is because rising prices of crude oil are often disruptive on a variety of variables, including inflation, production, and consumption, amongst others. Consequently, businesses will have a reduced need for long-term investments, which will result in a lower level of expected cash flows (Fattouh and Sen, 2021). The reason for this is the continued increase in the price of oil. In addition, households are confronted with increased degrees of uncertainty, which leads to a reduction in the quantity of durable items that they purchase. The increased uncertainty over the trajectory of future oil prices provides customers with a stronger incentive to preserve money rather than spend it. Worthy of note is the fact that as the price of crude oil continues to climb, deferring decisions about investments and consumption becomes increasingly tempting (Alaali, 2020). As a consequence of this, there is less of an incentive to spend or invest money, which in turn lowers expectations for economic advancement and, as a direct result of this, earnings on the stock market.

There exists an abundance of empirical literature on the impact of the oil price on firms and national economies which in many cases produce comparable findings and conflicting findings in other cases. The effect of the oil price on a business and a nation is equivalent for a variety of businesses and alliances. Using panel fixed effects and the generalized method of moments, Bugshan et al. (2021) conducted a study between 2005 and 2019 on oil price volatility and the corporate profitability of Shariah based and non-Shariah based businesses. It was found that during periods of significant oil price fluctuations, Shariah-compliant firms were more likely to fail than non-compliant businesses, according to the research. Additionally, the study discovered that the consequences of both positive and negative oil price shocks vary by company.

Over a 22-year period, Abdoh and Maghyereh (2020) investigated the effects of product market rivalry, oil price volatility, and corporate investment on publicly traded companies. The strategy of generalized methods of moments was implemented. Consistent with previous findings, it was found that crude oil price uncertainty has a negative correlation with investments. In addition, the research indicated that corporations limit their investments when faced with uncertainty. Mohanty et al. (2011) did a study on the Gulf Cooperation Council to investigate the connection between oil prices and stock returns using national and industry-specific data. Except for Kuwait, all GCC states and industries were found to experience positive, large, and asymmetric equity returns. The Gulf Cooperation Council (GCC) was chosen for the study because it holds 47% of the world's oil reserves. The model was calculated using linear component analysis.

There is no unanimity on how the price of oil affects the value of a company in the global economy. Alaali (2020) conducted a study on oil and stock price volatility and the degree of corporate investment, the generalized methods of moments was applied to a panel of publicly traded UK companies. The study revealed a U-shaped correlation between oil price volatility and corporate investment. In addition, the data revealed a correlation between the level of corporate investments and the volatility of stock prices. The research was carried out between 1986 and 2011. Maghyereh and Abdoh, (2020) investigated the various implications of oil price fluctuations on firm investment between 1984 and 2017and found that the impact of oil price volatility on corporate investment is diverse, with a bigger influence on oil and gas businesses.

Wang et al. (2017) did a study of Chinese enterprises to investigate the impact of shifting oil prices on the investment expenditures of listed companies. The research was conducted using a dynamic OLS regression model. The study concluded that uncertainty about oil prices has a negative impact on corporate investment, and that this impact is especially severe for privately held enterprises. Between 2000 and 2017, another study of publicly traded renewable energy companies in China indicated a negative association between corporate investment and oil price volatility. The research also indicated that the price of oil had no impact on Chinese firms' investments in renewable energy. This study utilized the system GMM method, the fixed effects model, and pooled OLS regression (Cao et al. 2020). According to a European study that shows evidence of spillover effects, the volatility of oil prices has a positive and substantial effect on the value of publicly traded enterprises. Before the 2008-2009 global financial crisis, no negative effects were evident. The study utilized a VAR model to explain the relationship of interest and a GMM for model estimation (Bagirov and Mateus, 2019).

Regional evidence from Africa indicates that oil producing enterprises and governments are the most affected by the volatility and unpredictability of the oil price. Ilyas et al. (2021) evaluated the role of oil price and economic policy ambiguity on business investment from 1991 to 2017 using a global sample of 4,017 oil sector firms. The findings revealed that corporate investment was negatively impacted by the volatility of the oil price and the unpredictability of economic policies. This adverse effect applies to all subsamples. In addition, it was established that oil-producing nations are more negatively affected by volatility of oil price and uncertainty of economic policy than oil-consuming nations.

A Tunisian study assessed the effect of oil prices on the market value of publicly traded companies. From 2007 to 2011, 19 enterprises were noticed in Tunisia. Using a stochastic frontier analysis, the study found that the price of oil negatively impacts on the equity value of enterprises (Zaabouti et al., 2016). This is comparable to the findings of Ilyas et al. Study on the GCC nations. According to Abdulkarim et al. (2021) a multivariate GARCH was utilized to examine the effect of oil prices on Islamic stock markets in Africa (2020) over the period 2011 through 2018. The analysis indicated a modest correlation between oil price and stock markets in Egypt and Tunisia. According to Zaabouti et al., oil price also negatively impacted on the Tunisian stock market.

In Nigeria, some studies have been conducted on the effects of oil price on the Nigerian Stock Exchange (NSE) and oil and gas companies. Prior to 2017, it was common practice to investigate how the price of oil influences macroeconomic indexes. Fowowe (2017) analysed the effect of fluctuating oil prices on the South African and Nigerian stock markets using a spill over index. The results suggested that oil price had a large and beneficial impact on both stock markets, albeit the effect was less obvious in South Africa. Using a VAR model to explain the link between prices of crude oil and investments in renewable energy in African states, Tambari and Failler, (2020) found that oil price shocks had a positive and statistically significant impact on African countries' investments in renewable energy. Daggash and Abraham (2017) discovered an identical phenomenon using the VAR Granger Causality Method.

Uzo-Peters et al. (2018) investigated the relationship between Brent crude oil pricing and the performance of publicly traded oil companies in Nigeria. It was found that fluctuations in the price of oil have a detrimental impact on the stock prices of Nigerian oil and gas businesses. This situation was unexpected as it should only apply to oil-importing countries, not oil-producing states like Nigeria. Adekunle et al. (2020) analyzed the relationship between crude oil prices and stock returns of nine publicly traded oil and gas companies in Nigeria between January 2014 and November 2019. The study indicated that crude oil prices had a significant impact on the predictability of stock returns for various Nigerian-listed oil and gas businesses. Agbo and Nwankwo (2019) investigated the impact of oil price volatility on Nigeria's all-share index using monthly frequency data from January 1997 to December 2016. In this study, the EGARCH approach was used to analyze the data. Control variables included in the model were the average monthly exchange rates and inflation rates. According to the results of the study, the volatility of oil price has a negative and statistically significant effect on the volatility of the all-share index.

Musa (2021) investigated the extent to which oil prices moderate the effect of these firm features on stock price volatility, as well as the linkage and forecasting ability of business fundamentals. The analysis found a correlation between the fundamentals of specific companies and their stock prices, with oil prices serving as a moderator. Although earnings per share and working capital are strong indications of stock price movement, fluctuations in the price of oil greatly limit their impact. A study applying the Capital Asset Pricing Model to determine the link between oil price and valuation of publicly traded Nigerian oil and gas enterprises was conducted using the estimation method described by Westerlund and Narayan (2015). The study indicates that the oil price has a substantial and positive effect on the market capitalization of publicly traded oil and gas companies. Moreover, when the price of oil varies, both positive and negative asymmetries have a significant impact on a company's value (Adekunle et al., 2020; Gershon et al., 2019). Several other studies also show that oil prices have a major impact on Nigeria's macroeconomic indicators (Mordi, 2006; Danmola, 2013; Osigwe, 2015; Abdulkareem and Abdulkareem, 2016; Popoola et al., 2022).

From the reviewed literature, it is obvious that the relationship between oil price volatility and stock market valuation of oil firms will depend to a large extent on several factors. For example, the question of whether the study is on economies that are net exporter of crude oil is key to the nature of findings. The nature of data used in the study also matter for the finding. Studies involving the use of firm level data appear to produce results that are strikingly different from those utilising macroeconomic data.

3. DATA AND METHODOLOGY

The empirical model for the study is designed to follow the stock valuation channel as advanced by Alamgir and Amin, (2021) and Degiannakis et al. (2018). In this case, a rise in oil prices, will boost an oil producer's predicted cash flows because it will increase profit margins. Consequently, investors in oil producing companies essentially behave bullish during periods of rising oil prices, and vice versa.

We begin the modelling by specifying a dynamic heterogeneous panel data model in which case the lagged term of the dependent variable appears among the regressors. This baseline specification is also referred to as panel autoregressive distributed lagged (Panel ARDL) model. The unrestricted specification for the baseline Panel ARDL (p, q_n) system of equation for this study is as follows:

$$ARDL\left(p,q_1,q_2,\ldots,q_n\right): Equity_{it} = \sum_{k=1}^{p}\zeta_{ik} Equity_{i,t-k} + \sum_{k=0}^{q}\phi_{ik}^{'} \mathrm{X}_{i,t-k} + \omega_i + \varepsilon_{it} \quad (1)$$

Where:

Where *Equity* is measured by market capitalization of firm *i* in period *t.* $X_{i,t}$=(K×1) vector of regressors for entity i, comprising: *oil price volatility, profitability of firm i in period t,* and *inflation rate* which is serving as a control variable. Data on market capitalization and firm profitability are from the Nigerian Stock Exchange, while data on inflation rate were sourced from the Central Bank of Nigeria. Variables included in the model may of course be I(0), I(1), or a mix of the two. The symbols included in equation (1) may be defined as follows:

ζ_{ik}= Coefficients of the lagged dependent variable (the autoregressive component)

ϕ_{ik}'=(*K*×1) vector of coefficients for the regressors (the distributed lagged component)

ω_i= Entity-specific fixed effects error term

ε_{it}= Idiosyncratic error term that is assumed to be *iid*.

The empirical process for implementing the panel ARDL model includes a test for panel unit root in each of the variables in the specified model to ensure that every variable in the specified model is integrated of order *I(d)* with *d<2*. Next, the specified Panel ARDL model may be estimated preferably using the pooled mean group (PMG) approach, thereafter, the result for each estimated regressor is interpreted paying attention to joint cointegration among the variables, speed of adjustment to long run equilibrium. Finally, inferences from the long-run causality and the short-run causality are drawn.

We reparametrize equation (1) to come up with the Panel ARDL vector error correction representation as follows:

$$\Delta Equity_{it} = \sum_{k=1}^{p-1}\zeta_{ik}^{*}\ddot{A}Equity_{i,t-k} + \sum_{k=0}^{q-1}\phi_{ik}^{*'}\ddot{A}\mathrm{X}_{i,t-k} + \varphi_i Equity_{i,t-i} + \gamma_i^{'} X_{it} + \omega_i + \varepsilon_{it} \quad (2)$$

i=1,2,…,N and t=1,2,…,T

The coefficients are further defined below.

$$\zeta_{ik}^{*} = -\sum_{m=k+1}^{p}\zeta_{im}, \qquad k = 1,2,\ldots,p-1$$

$$\phi_{ik}^{*} = -\sum_{m=k+1}^{q}\phi_{im}, \qquad k = 1,2,\ldots,q-1$$

$$\zeta_{ik}^{*} = -\sum_{m=k+1}^{p}\zeta_{im}, \qquad k = 1,2,\ldots,p-1$$

$$\varphi_i = -\left(1-\sum_{k=1}^{p}\zeta_{ik}\right)$$

$$\gamma_i = \sum_{0}^{q}\phi_{ik}$$

The panel ARDL vector error correction representation for the study may further assume the following form:

$$\Delta Equity_{it} = \sum_{k=1}^{p-1}\zeta_{ik}^{*}\ddot{A}Equity_{i,t-k} + \sum_{k=0}^{q-1}\phi_{ik}^{*'}\ddot{A}\mathrm{X}_{i,t-k} + \varphi_i\left(Equity_{i,t-i} + \gamma_i^{*'} X_{it}\right) + \omega_i + \varepsilon_{it} \quad (2^*)$$

Where: ϕ_i is the speed of adjustment coefficient from any short run disequilibrium in the system to the long run equilibrium path. ϕ_i in this case is the group-specific error correction representation which must be negatively signed for a meaningful error correction to occur in the system. As earlier stated, regressors can consist of a mix of I(0) and I(1) variables in the ARDL error correction framework. No I(2) or higher order of integration variable is permitted in the ARDL framework. Equation (2) comprises parameters of interest including: γ_i', a vector of long run coefficients which measures the long run impact of each regressor, and the short run coefficients are ζ_{ik}* and ϕ_{ik}'.

We are guided by the Hausman test result in estimating the panel ARDL model specified in equations (1) and (2) using the pooled

mean group (PMG) estimator as advanced by Pesaran, Shin and Smith (1999). The PMG estimator assumes that the long run coefficients are homogenous across groups or entities, while the short run coefficients vary across groups. The preference for the PMG estimator is further justified on the grounds that the alternative approaches-the dynamic fixed effects (DFE) and the mean group (MG) methods have extreme assumptions regarding the homogeneity of the short and long run coefficients across groups. for example, the DFE does not estimate coefficients for individual groups, and it assumes that slope coefficients and error variances are the same for all groups. The MG approach on its part, does not recognize the possibility that some parameters may be similar across groups, and the approach is inefficient if slope homogeneity holds. The key attraction of the PMG approach for this study is that unlike the MG, the PMG places a restriction of homogeneity on the long run coefficients, and unlike the DFE, the PMG allows for short run coefficients heterogeneity across groups. Given the underlying hypothesis of long run slope homogeneity, the PMG estimator is consistent and efficient.

The assumption of long run slope homogeneity under the PMG approach is a plausible assumption for this study for the following reasons: entities (oil companies) included are of the same industry and are likely to be faced with similar budget constraint; the entities are also exposed to similar demographic and operational environmental characteristics, and finally, the available production technologies tend to influence the industry in an identical or similar manner.

4. RESULTS AND DISCUSSION

The panel unit root tests result for all variables is reported in Table 1. The objective as stated earlier is to ascertain that every variable in the baseline model is integrated of order I(d) with $d < 2$. This condition must be satisfied to ensure that all estimation results of the panel ARDL model are stable and valid. As can be seen, two of the four variables (oil price volatility, *OPV* and inflation rate, *inflation*) included in our baseline model are integrated at level, I(0). The other two (equity and profitability) are first differenced stationary, I(1). With this mixed order of integration of all variables, and none of the variables exceeding I(1), the core requirement for the application of panel ARDL methodology is satisfied for this study.

The panel ARDL estimation results are reported next in Table 2. The results represent the outcome of estimation of equation (2*), and it embodies the short run dynamics of the relationship as well as the long run effects of each of the regressors on energy firm valuation (*Equity*) in Nigeria over the study period. Only the Pooled Mean Group (PMG) estimation of the short run effects results are reported in the first or upper panel of Table 1 for the sole reason that the Hausman test result favour the PMG over the MG and the DFE as our estimation approach of choice for this study. The long run results however include those of the PMG, MG, and DFE approaches just to allow for some comparison and robustness check. From the results, most of the variables performed impressively in terms of sign and magnitude of the estimated coefficients. The short run results are for each entity.

Interestingly, oil price volatility did not return statistically significant estimates for majority of the companies in the short run. Oil price volatility is usually triggered by disruptions in crude oil supply and demand conditions and such instability usually have implications for overall economic activity. Higher volatility would mean greater instability in crude oil prices, and lower volatility would mean greater stability for crude oil prices. For a net oil-exporting economy like Nigeria, an increase in oil price volatility triggered by external market forces, would mean higher instability in current and expected revenue for the economy and oil firms operating in the country. Businesses in general do not enjoy unpredictable business environments. Consequently, higher oil price volatility or unpredictable short term revenue inflows for the oil firms would increase the net risk of investing in stocks of

Table 1: Panel unit root tests for stationarity of variables

Variable assumption	Fisher-type unit root tests (statistic)				Remark
	Inverse χ^2	Inverse Z	Inverse logit	Modified Inverse χ^2	
Equity					
Drift	31.2445** (0.0270)	−1.6898** (0.0455)	−1.7814** (0.0405)	2.2074** (0.0136)	I (0)
Trend	8.3997 (0.9721)	1.8012 (0.9642)	1.7850 (0.9598)	−1.6001 (0.9452)	I (1)
No drift and trend	8.0942 (0.9772)	3.0503 (0.9989)	3.3248 (0.9992)	−1.6510 (0.9506)	I (1)
1st difference	201.1218* (0.0000)	−12.2324* (0.0000)	−18.6742* (0.0000)	30.5203* (0.0000)	I (1)
OPV					
Drift	181.7213* (0.0000)	−11.8109* (0.0000)	−16.8747* (0.0000)	27.2869* (0.0000)	I (0)
Trend	88.5813* (0.0000)	−7.3279* (0.0000)	−8.2135* (0.0000)	11.7635* (0.0000)	I (0)
No drift and trend	120.0619* (0.0000)	−9.0568* (0.0000)	−11.1469* (0.0000)	17.0103* (0.0000)	I (0)
Profit					
Drift	62.0680* (0.0000)	−5.1031* (0.0000)	−5.5618* (0.0000)	7.3447* (0.0000)	I (0)
Trend	14.9018 (0.6687)	0.2168 (0.5858)	0.2394 (0.5941)	−0.5164 (0.6972)	I (1)
No drift and trend	23.3416 (0.1778)	−0.6767 (0.2493)	−0.6938 (0.2455)	0.8903 (0.1867)	I (1)
1st difference	257.6122* (0.0000)	−14.4008* (0.0000)	−23.9219* (0.0000)	39.9354* (0.0000)	I (1)
Inflation					
Drift	102.9568* (0.0000)	−8.1551* (0.0000)	−9.5551* (0.0000)	14.1595* (0.0000)	I (0)
Trend	33.7436** (0.0135)	−3.0658* (0.0011)	−2.8551* (0.0031)	2.6239* (0.0043)	I (0)
No drift and trend	48.9952* (0.0001)	−4.5247* (0.0000)	−4.4360* (0.0000)	5.1659* (0.0000)	I (0)

*, ** Denote statistically significant at the 1% and 5% levels respectively. Values in parentheses=P value, Lags included in test = (#4)

Table 2: Panel ARDL estimation results

Short run effects (pooled mean group estimates)								
Dep. Var. Equity	**AGIP**	**CAPITAL OIL**	**CONOIL**	**ERTNA**	**FORTE**	**MOBIL**	**MRS**	**OANDO**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
D.OPV	−3906	5994	−1596	1060	2597	697	−175***	−31219
	(0.111)	(0.239)	(0.518)	(0.281)	(0.862)	(0.864)	(0.086)	(0.105)
D.Profit	−8152*	4196*	168*	104*	−169*	−8729*	5030	47312
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.266)	(0.585)
D.Inflation	47414*	3309*	−3635**	1591**	63411	−1029*	−6176	−3402
	(0.003)	(0.000)	(0.026)	(0.014)	(0.511)	(0.000)	(0.355)	(0.218)
Constant	7572*	1314*	30007	4645*	25271	31162*	5644	−1053
	(0.000)	(0.000)	(0.146)	(0.000)	(0.669)	(0.000)	(0.191)	(0.496)
Error Correction	−0.0016*	−0.0031*	−0.0036*	−0.00038	−0.0035	−0.008*	−0.003***	−0.0114
	(0.000)	(0.016)	(0.000)	(0.197)	(0.179)	(0.000)	(0.089)	(0.105)
Observations	1.719	1.719	1.719	1.719	1.719	1.719	1.719	1.719

Long run effects			
	Pooled mean group (PMG) estimates	**Mean group (MG) estimates**	**Dynamic fixed effects (DFE) estimates**
OPV	108694* (0.000)	−694077 (0.320)	−385 (0.947)
Profit	649* (0.008)	−214** (0.045)	−702 (0.947)
Inflation	99857* (0.009)	−191 (0.289)	−624 (0.948)
Hausmana		5.80 (0.3267)	
Hausmanb		0.14 (0.9340)	

*, **, *** Indicate statistically significant at 1%, 5%, and 10% level respectively, P values of the coefficient estimates are reported in ( ), [a]: Indicates results of Pooled Mean Group is more efficient than the Mean Group under the null hypothesis, [b]: Indicates results of Pooled Mean Group is more efficient than the Dynamic Fixed Effects under the null hypothesis

these oil firms, which will in turn, would likely depress equity valuation for the oil firms in the short run. Only the coefficient estimates of *OPV*, *MRS* and *Total* oil companies are statistically significant in explaining variations in the dependent variable over the short run horizon. Five of the nine coefficient estimates are negatively signed suggesting a decline in firm valuation during periods of increasing instability in crude oil prices and vice versa.

Profitability is largely correctly indicated with a positive sign and statistically significant in each case except for two companies, *MRS* and *OANDO* which are statistically insignificant. What this result suggests is that company equity valuation moves in the same direction as company profitability over the short run framework. For three of the oil companies, *AGIP, FORTE* and *MOBIL*, the sign of the coefficient estimates is negative suggesting that declining profitability drives stock prices of affected companies higher.

Inflation rate is a core indicator of macroeconomic performance and was included in the baseline model as a control variable. Estimates for the inflation rate variable are with mixed signs. It is positively signed in the case of *AGIP, CAPITAL OIL, ERTNA, FORTE,* and *TOTAL* oil companies, indicating an upward pressure of inflation on equity market valuation of these oil companies in the short run. The inflation rate variable is at the same time negatively signed for the other four oil companies, *CONOIL, MOBIL, MRS,* and *OANDO* in the short run. The mixed sign of the coefficient estimates for inflation rate may be rationalized for different groups of investors with varying risk appetite: for companies indicating a negative relationship between inflation and equity valuation, what the result indicates in this case is that equity values fall in the presence of rising rate of inflation. The rationale here will rest in the assumption that companies would resort to either equity or debt financing to meet the additional needs for external funds during periods of rising inflation. This will consequently raise the real cost of capital and impose a downward pressure on equity prices. In this case, rational investors will expect inflation to have a negative effect on future corporate earnings hence, they become bearish, which, in turn, will result in lower equity prices.

For companies that return a positive relationship between inflation and equity valuation, the likely explanation will be that rational investors here have higher risk premium on their investments and would be more bullish in investing in stocks of these oil companies with the goal of hedging against inflation, at least, in the short term.

The long run estimates under the PMG are statistically significant at the one percent level and each of the three regressors positively impact on oil company valuation in Nigeria. These results in effect suggest that oil price volatility, company profitability, and inflation rate are significant positive drivers of oil company valuation in the long run. The emerging reality from the long run estimates is that every scenario is a possibility as the markets have enough time to adjust in the long run. By comparison, the long run results for the MG and DFE indicate estimates that are in sharp contrast with the outcomes of the PMG estimates. The estimates here are all negatively signed and statistically insignificant except for estimate of the profitability variable which is statistically significant at the five percent level under the MG estimator. In any case, long run estimates must be viewed with great caution as all long run trends may be much less reliable than the short run projections.

5. CONCLUDING REMARKS

The paper examined the role of oil price volatility in equity valuation of listed oil companies in Nigeria and subjected the

analysis to the stock valuation channel theoretical postulation. The overwhelming weight of the evidence emerging from key findings of the study indicate that a distinctive difference exists between the short run impact of oil price volatility on equity valuation of oil firms in Nigeria from the long run impacts. While the short run results show a mix of negative and positive, but statistically significant impacts of oil price volatility on equity valuation across listed oil firms, the long run results indicate a statistically significant positive impact of oil price volatility on stock valuation of energy firms in Nigeria. The short run results are highly suggestive of the important role of the level of risk investors are willing to accommodate in their decisions to invest in stocks under different economic scenarios, in explaining stock returns for each of the oil producing firms in Nigeria.

Findings in this study clearly highlight the heterogenous nature of the short run impact of oil price volatility on equity valuation of oil firms in Nigeria. On this, the study stands out from previous related studies on the Nigerian economy. The key intuition from the long run results suggests a completion of the adjustment process, as variations in stock value of energy companies listed in the Nigerian stock market are significantly driven in the same direction as oil prices over the long run period.

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