INTEREST RATE CHANGES AND FINANCIAL PERFORMANCES OF OIL FIRMS IN THE AFRICAN STOCK MARKET.

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Abstract
Prices of oil and gas are generally known to be highly volatile and the recent price changes have caused several concerns for consumers, corporations and countries alike as they experience high dependency on oil and gas for transportation, electricity generation and industrial production. The specific objective of the study was to investigate interest rate change effect on financial performance of the oil and gas sector. The study also evaluated Firm size and firm age as a control variable. In so doing, data was sourced from active oil and gas firms quoted in the African Stock market. Panel data regression using Hausman's fixed effect and random effect models was adopted. However, the study also conducted other diagnostic tests like multicollinearity test using Variance inflation factor, Heteroscedasticity test, correlation analysis. Findings showed that Interest rate changes has positive and no significant effect on the performance of oil and gas firms listed on African stock market. Firm size does not have significant effect on interest rate and financial performance of oil and gas firms on the African stock market.
And recommend that, Oil and gas companies increase the price of their commodity in order to overcome the rise in interest rate, as such increase their profit. However, management can ignore interest rate fluctuations since it's not significant in determining the profitability of their firms. And that Government should find a way of stabilizing interest rate using its monetary policies to cub the fluctuations in oil price.
Key words: *Interest rate, financial performance, firms, stock market, Africa.*

Introduction

The African oil sector is characterized by its dynamic and diverse nature, with oil firms operating across different countries facing various regulatory, political, and economic challenges. Financial performance is a key metric that reflects an oil firm's ability to generate profits and create value for its shareholders. In the African oil sector, financial performance is influenced not only by interest rate changes but also by other factors such as operational efficiency, exploration success, and cost management. The financial performance of oil firms is typically evaluated using financial indicators such as return on equity (ROE), return on assets (ROA), and earnings per share (EPS) (Adesoji, 2016).The African stock market provides a platform for investors to assess the financial health and performance of oil firms. However, the financial performance of these firms can vary significantly based on

their size and operational characteristics, making it essential to explore the moderating effect of firm size on market risk and financial performance.

Oil and gas prices are notoriously unstable (Pindyck, 2011; Harley 2018), and the recent price changes have raised a number of issues for individuals, businesses, and entire nations due to their high dependence on these commodities for industrial production, transportation, and electricity generation. With varied degrees of success, a number of authors, including Alquist and Kilian (2010), and Ozuomba, Nwadialor and Ogujiofor (2020), have investigated risk forecasting models in an effort to better comprehend these price variations. Since then, as demand from developing nations like China and India has grown, so has the price of oil. The fact that the majority of firms produce a portfolio of oil-related products for which prices are all highly correlated (Asche, Gjolberg and Volker, 2003; Asche, Osmundsen and Sandsmark, 2006; Panagiotides and Ruthledge, 2007; Brown and Yucel, 2009)

Despite the pressing need to control the risk associated with changes in oil prices, research on risk measurement in the oil sector is currently lacking. Numerous scholars have really researched the numerous dangers that impede the efficient operation of the financial sector of the economy in a number of African countries and elsewhere. Oyerogba and Ogunlde (2016), for example, examined the connections between the financial sectors in a few African nations, while Ekinici (2016) investigated the same in Turkey and Muriithi, Muturi, and Waweru (2016) examined risks and bank performance in Kenya. These studies are based on the financial industry since people believed that the banking sector was what connected their economies to the rest of the globe. However, because it is evident that the oil and gas sectors in African countries are similar and essential to the economy, it is necessary to undertake studies on how interest rate risk has influenced the performances of the oil and gas business in the African Stock Exchange, and this is one of the gaps filled by this study. The broad objective of this study is to investigate the moderating effect of firm size on interest rate changes and financial performances of oil firms in the African stock market. The study is required to achieve the following specific objective; to ascertain the relationship between interest rate changes and the financial performance of oil firms in the African stock market. To achieve the specific objectives, these hypotheses were stated:
Ho1: Interest rate change has no significant relationship with the financial performance (ROA) of oil firms in the African stock market.

Theoretical Framework

This study is anchored on this capital assets pricing model theory. Sharpe (1964) and Lintner (1965) invented the CAPM theory. Though it was a development on the portfolio model built by Markowtiz (1952), by adding two assumptions which say that; one-investors are risk averse, two-when choosing among portfolios, investors

care only about the mean and variance of their one period investment return (Rossi, 2018).The capital asset pricing model (CAPM) is used to determine a theoretically appropriate required rate of return of an asset, if that asset is to be added to an already well-diversified portfolio, given assets non-diversifiable risk.

According to Ngugi (2014), interest rates are fundamental to a "capital society" and are normally expressed as a percentage rate over the period of one year. Financial performance is a business operation activity to determine how economically well or profitable the business has done within a particular period. Financial performance refers to those outcomes that can be measured monetarily, especially with figures from the set of financial statements. In other words, financial performance is the extent to which financial goals or obligation of a firm is being accomplished. Ekincini (2016) reported that interest rate has positive significant impact on the returns of banks in Turkey. Ildirar et al (2016) found that rising interest rate has negative and no significant effect on average capacity utilization of manufacturing firms in Nigeria. Meanwhile Egbunike and Okerekeoti (2018) examined and found that interest rate has no significant effect on the financial performance of firms in Nigeria.

Musawa and Mwaanga (2017) employed descriptive statistics, Auto Regression Distribution lag bound test, and Vector Auto Correction base co-integration model to analyses data generated, in assessing the effect of commodity prices, interest rate and exchange rate on the performance of Zambian stock exchange from 2004 to 2016. The results have it that exchange rate, interest rate, copper and oil price jointly have long run and short run effect on the Zambian stock market. But on the individual variables, interest rate and copper price have long run significant effect on the Lusaka Stock Market, thought in a short run, only copper price and exchange rate immediate effect on the Lusaka Stock Market. Both studies are similar since both focus on market risk but differs in their method of data analysis.

Ildirar et al (2016) investigating the impact of rising interest rate on the performance of the Nigerian manufacturing sector of thirty five years, covering 1981 to 2015. The study employed ex post facto research design and generated data from the Central Bank of Nigerian Statistical Bulletin for the relevant years, wherein maximum lending rate was used as the exogenous variable, average manufacturing capacity utilization and contribution of manufacturing sector to GDP were the endogenous variables. The data was analyzed using Ordinary Least Square (OLS) regression after it was tested for stationarity, though the result of the stationary test was not shown. The regression result thereof indicated that the rising interest rate in selected African Countries has a negative effect and insignificant effect on the average capacity utilization of the Nigerian Manufacturing sector. Both studies are similar

since both focus on stock market but differs in their method of data analysis.

Methodology

The research design of expo facto (after the event) was adopted considering the specific objectives and the panel statistical technique that were applied. This study covered active quoted oil and gas firms in the African stock market for a period of ten years starting from 2013 to 2022. This period provoked the study because of the economic depression witnessed generally in the world economy within the period, especially the outbreak of covid-19 pandemic. Secondary data were used since studies have proven the validity and reliably of the empirical result using secondary data. The population of this study consisted of the10 active quoted oil and gas firms in the African Stock market as at 31st December 2022. The active quoted oil and gas firms as at 31st December 2022 are as follows:

S/N	Oil and gas firms	country
1	African Clean Energy Solution (ACES.mu)	Mauritius
2	Conoil Nigeria plc (CONOIL.ng)	Nigeria
3	Eterna Nigeria plc (ETERNA.ng)	Nigeria
4	MRS oil Nigeria plc (MRS.ng)	Nigeria
5	Seplat Energy Marketing Nigeria plc (SEPLAT.ng)	Nigeria
6	Total Energy Marketing plc (TOTAL.ng)	Nigeria
7	Swala oil and gas (SWALA.tz)	Tanzania
8	Tol gases ltd (TOL.tz)	Tanzania
9	Umeme ltd (UMEME.ug)	Uganda
10	Puma Energy Zambia plc (PUMA.zm)	Zambia

Source: African Stock Market, 2023

Panel data regression using fixed effect and random effect models was adopted in order to control for individual unobserved heterogeneity, obtain more accurate results (Temple, 1999; Woodridge, 2002; and Hsiao, 2003 as cited in Alajekwu, 2018). Cross-sectional and time series data are pooled in the regression to overcome the problem of insufficient degree of freedom. However, the study also conducted other diagnostic tests like multicollinearity test using Variance inflation factor, which checked if the independent variables of the study were highly correlated among themselves; Heteroscedasticity test, which checked for the presence of an outlier or whether the residual of the error term is constant and variable omission test that checked if the model was miss-specified.

Decision rule for regression analysis: It is interpreted as the proportion of the variance in the dependent variable that is predictable from the independent variable. Its decision rule is +1 or -1.

Model : Return on Assets (ROA) model: tested as stand-alone variables.
ROA = F (INTR, FS, FA)
$ROA = \alpha + \beta_1 INTR_{it} + \beta_2 FS_{it} + \beta_3 FA_{it} + \varepsilon_{it}$ *.....equ (1).*
Where:

B_1	=	Coefficient of Proxies of independent variable
B_2	=	A Coefficient of control variable
ROA	=	an indicator representing return on asset (proxy for dependent variable).
INTR	=	Interest rate
FS	=	Firm size
FA	=	Firm age
e	=	Error term
i	=	firm
t	=	time

Apriori expectations: $B_1, > 0$

Data Presentation

Table Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	79	.7078377	26.4026	-19.45	18.45
FS	79	6.878957	3.730893	5.85	10.94214
FA	80	16.025	12.2112	3	43
INTR	77	7.423766	5.244648	-3.7	21.5

Source: Stata 2014 output

The descriptive statistics of the data as presented in table 4.2 above observed that, return on assets (ROA) has a mean of 0.7078 with maximum and minimum values of 18.45 and -19.450 respectively. The values indicated that wide variation exists among the oil firms in their earning potentials across the nations as the standard deviation is higher than the mean value. The mean of Firm size (FS) that was measured with log of total assets is 6.87 with standard deviation of 3.75, the maximum value is 10.94 while the minimum is 5.85. The table also revealed that firm age (FA) indicates that the firms have been in operation for an average period of 16years. The maximum age of the firms studied is 43 years while the minimum age of the firms is 3 years. The standard deviation of the firm age that is far below the average value shows that the firm's age is not dispersed. Again, interest rate (INTR) has average value of 7.42%, maximum value of 21.5% and minimum value of negative 3.7%, the standard deviation 5.24 also proves that the values cluster around the mean and are not widely dispersed.

Test for Normality of Residua

The assumption to make when testing for normality residua is that "sample distribution is normal". Hence, the distribution is not normal if the test is significant at 5% or 1% level. This study adopted the Shapiro-Wilk test for normality of residua test procedure for n =10 to n =2000 this is in line with the position of Razali and Wah (2011). Consequently, the study conducted the test for normality of residua as shown in the table below:

Table Shapiro-Wilk W test for normal data

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
ROA	79	0.34032	44.816	8.326	0.00000
FS	79	0.86882	8.912	4.789	0.00000
FA	80	0.93179	4.682	3.382	0.00036
INTR	77	0.96528	2.310	1.830	0.03361

Source: Stata 14 output

The normality result in table 4.2.2 above shows that the joint probability of ROA= 0.000, FS= 0.000, FA=0.000 and INTR=0.033 are not normally distributed since their joint probability value is less than and equal to 5% critical value. These results were obtained from the probability z statistics as revealed in the above table. Following this finding, the study shall continue with non-parametric approach to testing the relationship among the variables, using Spearman correlation.

Correlation Analysis

With non-normal data which the normality of residua test result reveals, alternatives to the Pearson approach might be justified. The robustness of Spearman's versus Pearson's test has received relatively less empirical scrutiny. In one of the few studies, Fowler (1987) found that Spearman's r was more powerful than Pearson's r across a range of non-normal bivariate distributions.The power benefit of Spearman's r may be the result of rank-ordering causing outliers to contract toward the centre of the distribution (Gauthier, 2001). Upon this understanding and based on the fact that the data set followed a non-normal distribution, the study employs the Spearman Rank Correlation technique to conduct the possible association between the variables of interest shown in the table below;

Table Correlation Matrix Analyses

```
+-----------------+
| Key             |
|-----------------|
|   rho           |
|   Sig. level    |
+-----------------+
   |     ROA      FS      FA      INTR
----+------------------------------------------------------------------------

ROA |   1.0000
   |           |
 FS |  -0.2989*  1.0000
   |   0.0107
   |
 FA |  -0.2720*  0.6883*  1.0000
   |   0.0208   0.0000
   |    |
INTR|   0.1056  -0.0790  -0.4946*  1.0000
   |   0.3773   0.5097   0.0000
   |
```

Source: Stata 14 output

Specifically, the analysis from the spearman rank correlation showed that firm size (-0.2989), firm age (-0.2720), have negative and low correlation with return on assets of the oil firms listed on the African stock market for the period covered. However, interest rate (0.1056) has a positively low correlation with return on assets on the oil firms listed on the African stock market. Meanwhile, additional disclosure have it that firm age has positive and strong correlation with firm size (FA/FS=0.6883). The result did not indicate any high correlation among the independent variables since no correlation coefficient is higher than 0.8. However, the study shall engage variance inflation factor to test proper whether high collinearity problems exists.

Table Multicollinearity Test using Variance Inflation Factor

```
   Variable |      VIF       1/VIF
------------+----------------------
         FS |     6.40    0.115772
    INTR_FS |     1.83    0.353118
       INTR |     1.80    0.372443
         FA |     1.54    0.382380
------------+----------------------
   Mean VIF |     2.61
```

The Variance Inflation Factor (VIF) statistics as presented above was used to ascertain the presence of multicollinearity. The decision rule being that VIF-statistic

above ten (10) indicates multicollinearity, otherwise it does not give cause of concern and it is observed that, none of the variables have VIF's values more than 10 and hence none gave serious indication of multicollinearity.

Table Heteroskedasticity Test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of ROA
chi2(1) = 32.64
Prob >chi2 = 0.0000

Source: Stata 14 output

Heteroscedasticity test has a decision rule that there is no heteroscedasticity if the probability of F value is greater than the critical value were at 5% level. The table 4.2.5 above indicates that probability value of 0.0000 is lesser than the critical value of 0.05. Therefore, we conclude that there is heteroscedasticity, which means there is no constant variance.

Table 4.2.6 Hausman Test

Test: Ho: difference in coefficients not systematic

chi2(12) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 35.82
Prob>chi2 = 0.6003

Source: Stata 14 output

The Hausman test shows a P value (0.6003) that is higher than 5% critical value which is an indication that random effect result is better than fixed effect result, therefore we concludes to use random effect result for making inferences. More so, random effect panel regression technique has the capacity to redress the absence of homoscedasticity.

Panel Regression Analysis

The study employed panel regression analysis to ascertain the cause and effect links between our explanatory variables and the dependent variable, as well as used this analysis for testing the formulated hypotheses. The summarized results of the panel regression analysis are presented in the table below.

Table Summary of Regression Estimation

	Random effect result	**Fixed effect result**
	Coefficient ( ) p-value [ ] z-stat	Coefficient ( ) p-value [ ] t-stat
INTR	13.471 (0.134) [1.50]	21.302 (0.010) [2.66]
	Random effect result	**Fixed effect result**
FS	16.043 (0.548) [0.60]	36.412 (0.397) [0.85]
FA	1.0526 (0.589) [0.54]	7.604 (0.436) [0.78]
control variable		
*INTR*FS*	-2.220 (0.089) [-1.70]	-3.946 (0.006) [-2.87]
R^2	0.3955	0.6269
Adj R^2	0.3405	0.6168
F-Stat	19.31	17.70
P(f-stat)	0.0001	0.0000
Hausman		0.6003
Ramsey RESET Test		0.000

From the table 4.2.7 above, it is seen that the F-statistics and its corresponding P-value were 19.31(0.0001) and 17.70(0.000) for random effect model and fixed effect model respectively. This shows that both models are valid for drawing inferences since they are both statistically significant at 1% levels. The R-squares (i.e. the regression coefficient) for both models were shown as 0.3955 and 0.6269 for random effect model and fixed effect model respectively. This value indicate that 39.6% and 62.7% of the systematic variations in firm financial performance, measured with return on assets (ROA) is explained by all the explanatory variables as jointly used for random effect and fixed effect models respectively.

The fixed effect panel regression estimation was based on the assumption of no correlation between the error term and the independent variables, whereas the model of the random effect is performed on the bases that the error term and the independent variables are correlated. Put differently, Random Effects models has the capacity to correct for omitted variable bias, and presence of autocorrelation and

heteroscedasticity in panel data. Therefore, it will provide a remedy to variable specification error and heteroscedasticity problems found in the study data.
However, it is a convention to introduce a mechanism that will help make a choice between the two panel regression estimator (fixed effect model and random effect model) to rely on. The Hausman Test was used as that mechanism. It is a rule of the Hausman Test to assume that Random Effect result is better applied to fixed effect result on the null hypothesis. The table 4.2.6 & 4.2.7 present that probability of the Hausman Test is 0.6003, which implies non-significant at 5% level. Therefore, the study accepts null hypothesis and by the standard of Hausman Test, random effect panel regression result is more appealing for the discussion and making inferences. To this end, the study applied random effect result in testing its hypotheses as presented below.

Test of Hypotheses

Hypothesis 1: Interest rate change does not have significant relationship with the financial performance (ROA) of oil firms in the African stock market.
The result in table 4.2.7 shows that interest rate (INTR) has coefficient of 13.471, which shows that interest rate has positive effect on financial performance (return on assets) of oil firms listed on African market. The z-test [z=1.50] and the corresponding P-value (p=0.134), that is higher than 5% critical value, shows that interest rate has no significant effect on the financial performance of oil firms listed on the African stock market. By implication however, a unit increase on interest rate would cause a 13.4 unit change on the financial performance of oil firms, if other variables are held constant. Therefore, the study failed to reject null hypothesis and concluded that interest rate has positive and no significant effect on financial performance, (proxyas ROA) of oil firms listed on the African stock market.

Control variable: Firm size does not significantly moderate the relationship between interest rate and financial performance of firms on African market.
The random effect regression results obtained from the model of our sampled firms on African stock market revealed that firm size has an insignificant moderating and negative effect on the relationship between interest rate and financial performance of the oil firms during the period under investigation. This is shown as; interest rate (moderated; Coef. = -2.220, z = -1.70 and P -value = 0.089). Specifically, this result means that the size of the oil firms has no significant moderating effect on the ability of interest rate, to cause changes on the financial performance of the firms studied. This finding is consistent with the null hypothesis that firm size does not significantly moderate the relationship between interest rate and financial performance of firms on the African stock market.

Findings

(a) Interest rate changes has positive and no significant effect on the performance of oil and gas firms listed on African stock market.
(b) Firm size does not have significant moderating role on the relationship between interest rate and financial performance of oil and gas firms on the African stock market.

Conclusion

More importantly, the study concluded that size of the firm is highly important in determining how interest rate and financial performance of oil and gas firms listed on African stock market associate.

Recommendations

The under listed recommendations were made from the empirical findings of the study thus;
(a) Government may find a way of stabilizing interest rate using its monetary policies to cub the fluctuations in oil price. Oil and gas companies increase the price of their commodity in order to overcome the rise in interest rate, as such increase their profit. However, management can ignore interest rate fluctuations since it's not significant in determining the profitability of their firms.
(b)The managements of oil and gas firms are encouraged not to consider the size of the firm in decision or deliberation of how the interest rate will impact on the financial performance. In order words, the size of the firm does not matter on how interest rate changes affects firm profit making.

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