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CORPORATE STRUCTURE AND EARNINGS MANAGEMENT OF LISTED OIL AND GAS FIRMS IN NIGERIA

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Abstract

This paper investigates the relationship between corporate structure and earnings management of listed oil and gas firms in Nigeria for the period 2006 to 2015. Data was obtained from a sample of seven firms out of the population of nine firms through their annual reports and accounts. Corporate structure as an independent variable was proxied by leverage, tangibility, firm size and firm age, while the residuals from the modified Jones Model by Dechow et al (1995) was used to represent earnings management. The study adopted ordinary least square multiple regression technique in analyzing the data. The findings revealed that leverage, tangibility and firm size have

negative impact on earnings management, while firm age has significant positive impact. It is recommended that the firms should increase the percentage of debt in their capital structure and also increase their investment on fixed assets as well as expanding the size of their operations, since the result provides evidence that leverage, tangibility and firm size have negative effect on earnings management.

Keywords: *Leverage, Tangibility, Firm Size, Firm Age, Earnings Management*

1.1 Introduction

Accounting information provided in the financial statements is associated with manipulation by management which reduces the quality of earnings and usefulness of decision making process (Dabor & Adeyemi, 2009). As a result of separation of ownership from control of business entity, there is tendency for managers of companies to engage in fraudulent financial reporting to protect their interest at the detriment of the interests of users of financial information (Dabor & Adeyemi, 2009).

Corporate entities are associated with unethical accounting practice by the management with the aim of satisfying their personal interest at the expense of the companies they manage which may eventually lead to the collapse of those firms (Roodposhti & Chashmi, 2011). These unethical accounting practices are viewed as earnings management (Roodposhti & Chashmi, 2011). Earnings management involves alteration of financial information to mislead some stakeholders about the underlying economic condition of business organizations or to influence contractual outcomes that depend on reported earnings (Zhu & Tian, 2009).

Corporate structure represents the various financial information disclosed on firms' financial statement for a particular accounting period which shows the firms' structure of capital, size of operations, sources of revenue as well as the expenditure incurred in the firm. Corporate entities are structured in terms of their leverage, assets size, and period of operation and areas of coverage of operations among others that would enable the firm to achieve its target objectives. Leverage finance refers to the funding a company or business entity with debt. It is commonly employed by a company to achieve a specific or temporary objective, such as acquisition of another business, to effect a buy-out, to purchase shares or fund a one-time dividend, or to invest in self-sustaining cash-generating assets (Pachori & Tatala, 2012). Tangibility represents the physical assets of firm which is measured as the proportions of firms' fixed assets to its total assets, while the firm size of business entity refers to the speed and extent of growth that is ideal for a specific company. Most companies are intent to expand the size of their

business operation for them to grow either in revenue, profit, number of employees, or size of facilities (Pervan & Visic, 2012). Firm age is the period in which the company is operating in line with the going concern concept of accounting which can assist the firms to checkmate the activities of its management in order to achieve its target goals.

The existing empirical studies on corporate structure and earnings management of companies in developed nations and emerging economies provide mix results, for example the work of Hamza and Lakhal (2010), Choi and Kim (2013), Januarsi, Badina and Febrianti (2014), and Uwuigbe, Ranti and Bernard (2015). Hence, the nature of the relationship between corporate structure and earnings management remain controversial which creates a gap for further studies.

The areas of corporate structure and its effect on earnings management have attracted a lot of interest by researchers such as Alsharairi and Aly (2011) and Aries (2015). Many researchers have attempted to examine the effect of corporate structure on earnings management of firms using difference proxies of corporate structure. The studies however suffered two limitations. First, most of the studies in this area ignored the importance of inclusion of tangibility as corporate structure proxy in one study in examining earnings management of firms. Second, the studies seemed to have focused more attention on financial sector and some subsectors of the manufacturing sector in exclusion of downstream oil and gas sector despite its strategic importance to the Nigerian economy. The quest for individuals and corporate organizations to use petroleum products for transportation of goods and services as well as other industrial operations in Nigerian economy has made oil and gas firms an important sector to be study in the country. Therefore, this seeks to examine the relationship between corporate structure and earnings management of listed oil and gas firms in Nigeria. Therefore, the study generally seeks to examine the impact of corporate structure on earnings management of listed oil and gas companies in Nigeria.

This paper is organized as follows: the next section describes the review of empirical studies and theoretical framework. The third section explains the research method, data collecting process and model specification. The research results are presented and discussed in section four, followed by conclusion and recommendations in section five.

2.1 Review of Empirical Studies and Theoretical Framework

2.1.1 Leverage and Earnings Management

Ardison, Martinez and Galdi (2012) examined the impact of leverage on earnings management of listed firms in Brazil for the period 1994 to 2010 and found an evidence of insignificant positive relationship between leverage and earnings management. Aries (2015) explored the influence of leverage on earnings management of listed firms on Indonesian Stock Exchange for the period 2009 to 2013 using a sample of 30 manufacturing firms. They found evidence of insignificant positive relationship between leverage and earnings management. Further, Takhtaei, Ojaghi and Esfandabadi (2013) studied the impact of financial leverage on earnings management of listed firms on Tehran Stock Exchange for the period 2002 to 2008. The analysis of data was carried out using pooled ordinary least square regression and the result reveals a significant negative relationship between leverage and earnings management of the selected firms.

However, Januarsi, Badina and Febrianti (2014) studied the effect of leverage on earnings management of listed firms on the Indonesian Stock Exchange for the period 2009 to 2011 and found significant negative relationship between leverage and earnings management. Similarly, Alsharairi and Aly (2011) investigated the influence of high leverage on earnings management of listed firms in United State for the period 1999 to 2008. Multiple regression was used for data analysis and the result reveals an evidence of significant negative relationship between leverage and earnings management of the firms. Most of these studies failed to mention the approaches they used to measured leverage as a variable of the studies.

2.1.2 Tangibility and Earnings Management

Empirical studies have been conducted on the relationship between assets tangibility and earnings management by firms. For example, Walid, Bonsall, Kokharki and Penn (2013) examined the relationship between assets tangibility and earnings management of listed firms in the United States. Multiple regression was used for data analysis and the result reveals a significant positive relationship between tangibility and earnings management. However, Kim, Yura and Song (2013) studied the impact of credit rating changes on earnings management of listed firms in United State for the period 1990 to 2011 and found evidence of significant negative relationship between tangibility and earnings management of firms. However, Bizjak, Hayes and Kalpathy (2014) examined the effect of performance-contingent awards on earnings management of 750 listed firms on United State for the period 1998 to 2012. They employed panel data multiple regression technique and found evidence of insignificant negative relationship between tangibility and earnings management of the selected firms. These studies focused more attention on other sectors of the economies while ignoring the strategic importance of oil and gas companies.

2.1.3 Firm Size and Earnings Management

Several studies have been conducted around the world on the relationship between firm size and earnings management of firms. Some studies found positive and negative significant relationship between firm size and earnings management while others found no evidence of any relationship. Fairfield, Pinkowitz and Tang (2008) studied the impact of acquisition to mask earnings management of listed firms in United State for the period 1988 to 2007 and adopted multiple regression as statistical tool of analysis. Their findings revealed a significant positive relationship between firm size and earnings management. Hamza and Lakhal (2010) examined the determinants of earnings management of listed firms in France using a sample size of 108 firms for the period 1998 to 2008 and found significant negative relationship between firm size and earnings management. They failed to mention the sampling technique used to arrive at the sample size of the study.

Uwuigbe, Ranti and Bernard (2015) studied the effect of firm characteristics on earnings management of 20 listed firms on the Nigerian Stock Exchange for the period 2006 to 2010 and found evidence of significant positive relationship between firm size and earnings management. In contrast, Aries (2015) found evidence of insignificant positive relationship between firm size and earnings management. Furthermore, Ardison, Martinez and Galdi (2012) examined the impact of leverage on earnings management of listed firms in Brazil for the period 1994 to 2010 and found evidence of insignificant positive relationship between firm size and earnings management. However these studies failed to conduct robustness test in analyzing their data in order to improve the validity and reliability of the statistical results.

2.1.4 Firm Age and Earnings Management

Extant empirical works have established relationships between firm age and earnings management; however, the results are diverse. For example Choi and Kim (2013) investigated the impact of reputation on earnings management of Korean firms for the period 1993 to 2007 using multiple regression as a statistical tools of analysis. Their result reveals evidence of an insignificant negative relationship between firm age and earnings management. In contrast, in a study of the the effect of directors' career concern on earnings management, Demers and Wang (2010) found evidence of insignificant positive relationship between firm age and earnings management of the firms.

Furthermore, Asija, Marisetty and Rangan (2014) studied the impact of insiders' shareholders on earnings management of listed firms in India for the year 2009.

They used ordinary least square regression for data analysis and found evidence of insignificant positive relationship between firm age and earnings management of the firms. However, Bizjak, Hayes and Kalpathy (2014) found evidence of insignificant negative relationship between firm age and earnings management. Most of these studies failed to mention the population and sampling techniques used to arrive at the sample size of their studies as well as the research design used in their studies.

2.2 Theoretical Framework

Signaling theory is concerned with understanding why certain signals are reliable and others are not in terms of decision making. The theory looks at the quality and reliability of accounting information released by companies to their users for investment decision making by the potential investors. Spence (1973) posited that a well performing firm distinguishes itself from the nonperforming one by sending a credible signal about its performance to capital markets as well as potential investors. Signals sent by a firm are the results of its operating activities which would inform investors about the company's future prospects. The theory assumes that managers and shareholders of a company differ in terms of getting access to some vital information about firm operation. Some information can only be accessed by the managers while the shareholders do not have access to such information.

Signaling theory was adopted in this study to underpin corporate structure represented by leverage, tangibility, firm size and firm age, because leverage would enable the company to have a sound capital structure position which is showing its ability to meet up with its both long and short term financial needs without obstruction in production. Also, effective assets and cost management would enable a company to minimize its operating costs of production thereby leading to an improvement in firm's financial performance as well as reducing the level of earnings management which is showing a good signal to both current and potential investors that the company can continue to operate in line with the going concern concept of accounting as well as satisfying the interest of its stakeholders.

3.1 Methodology

Correlation research design was adopted because the study attempts to measure the relationship between corporate structure and earnings management of listed oil and gas firms in Nigeria. The population of the study consists of all the 9 listed oil and gas companies (Afroil plc, Beco petroleum product plc, Conoil plc, Eterna oil & gas plc, Forte oil plc, Mobil oil Nigeria plc, MRS oil Nigeria plc, Oando plc and Total Nigeria plc) on the Nigerian Stock Exchange for the period of 10 years (2006 - 2015). In view of the non-availability of comprehensive data for two of

the firms (Afroil plc and Beco petroleum product plc), the study covered only seven firms. The annual reports and accounts of the firms were used to obtain required data for the study. Robust ordinary least square regression was adopted for data analysis in order to establish the relationship among the variables of the study.

3.1.1 Variables Definition and Measurement

The independent variables of the study are leverage, tangibility, firm size and firm age, while earnings management is the dependent variable.

The dependent and independent variables used in the model are explained as follows:

Variable Acronym	Variable Name	Variable Measurement and Source
EM	Earnings Management	Measured by absolute values of the residuals (discretionary accruals) using Modified Jones model by Dechow <i>et al.</i> (1995).
LVG	Leverage	Measured as the ratio of total debt to total assets (Arise, 2015).
TGB	Tangibility	Measured as ratio of fixed assets to total assets (Kim, Yura & Song, 2013).
FS	Firm Size	Measured as the natural logarithms of firms' total assets (Hamza & Lakhal, 2010).

FAG	Firm Age	Measured as the natural logarithms of period of firm listed on the Nigerian Stock Exchange (Choi & Kim, 2013).
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Source: Compiled by the Author from various literature, 2016

Two steps regression was used in determining the earnings management of listed oil and gas firms in Nigeria, by adopting modified Jones Model by Dechow *et al.* (1995). The residual of the model is given below:

$$DAC_{it} = \frac{TAC_{it}}{TA_{it}} - (1/TA_{it} + \beta_{it} [\frac{\Delta REV_{it}}{TA_{it}} - \frac{\Delta REC_{it}}{TA_{it}} + \frac{PPE_{it}}{TA_{it}}]) + \varepsilon_{it}$$

Where:

TAC = NI - CFO

DAC = Discretionary Accruals

TAC = Total Accruals

NI = Net operating income

CFO= Cash flow from operating activities

1= Constant

β = Beta

ΔREV = Revenues in year t less revenues in year t -1

ΔREC = Receivable in year t less receivables in year t -1

PPE = Gross property plant and equipment in year t

TA = Total Asset

ε = Error Term

i = Number of firms

t = Time period

3.1.2 Model Specification

The model used to empirically estimate the relationship between corporate structure and earnings management is as follows:

$$EM_{it} = \beta_{0it} + \beta_1 LVG_{it} + \beta_2 TGB_{it} + \beta_3 FS_{it} + \beta_4 FAG_{it} + \varepsilon_{it}$$

Where:

EM= Earnings Management

LVG= Leverage

TGB= Tangibility

FS= Firm Size

FAG= Firm Age

ε_{it} = Error Term and Firm *i* at time *t*

4.1 Results and Discussion

This section presents the descriptive statistics, correlation matrix and summary of multiple regression results.

Table 4.1 Descriptive Statistics

Variables	Obs.	Min.	Max.	Mean	Std. Dev.
EM	70	0.0012	0.6631	0.1417	0.1374
LVG	70	0.5017	0.9489	0.7510	0.0929
TGB	70	0.0587	0.5658	0.2467	0.1306
FS	70	13.7870	20.6060	17.1823	1.6260
FAG	70	1.0000	38.0000	24.0857	10.8691

Source: Stata Output, 2016

From Table 4.1, the minimum and maximum values of discretionary accrual are 0.0012 and 0.6491 respectively. The average value of discretionary accrual is 0.1417 while the standard deviation is 0.1374. The minimum and maximum values of leverage of listed oil and gas firms in Nigeria are 0.5017 and 0.9489 respectively. The average value of leverage is 0.7510 with a standard deviation of 0.0929 which implies that the data deviated from the mean with 0.0929. The firms' tangibility shows minimum and maximum values of 0.0587 and 0.5658 respectively. Also, the average tangibility of listed oil and gas firms in Nigeria revealed a value of 0.2467 and standard deviation of 0.1306 indicating that the data level of deviation from the mean is 0.1306. The firm size shows minimum and maximum values of 13.7870 and 20.6060 respectively. The mean of firm size stands at 17.1823 while the standard deviation value is 1.6260; this implies that the data deviate from the mean with 1.6260. Also, firm age has minimum and maximum values of 1 and 38 respectively. The average value of firm age is 24.0857 and the standard deviation of 10.8691 signifies the level of deviation of the data from the mean at 10.8691.

Finally, among the explanatory variables leverage has the lowest value of standard deviation of 0.0929. This signifies that leverage has the lowest level of

dispersion to earnings management of listed oil and gas firms in Nigeria, while firm age has highest value of standard deviation of 10.8691 which implies that firm age has the highest level of dispersion to earnings management of Nigerian oil and gas firms.

Table 4.2 Correlation Matrix

Variable	EM	LVG	TGB	FS	FAG
EM	1.000				
LVG	-0.0854 (0.4820)	1.000			
TGB	-0.2394* (0.0459)	-0.1583 (0.1907)	1.000		
FS	-0.2382* (0.0470)	-0.0710 (0.5592)	0.2614* (0.0288)	1.000	
FAG	0.1024 (0.3989)	-0.1755 (0.1462)	0.2554* (0.0328)	0.1857 (0.1237)	1.000

Source: Stata Output, 2016

Table 4.2 reveals that leverage of the firms is negatively correlated with earnings management with the coefficient value of -0.0854 and p-value of 0.4820 which is not significant at any level of significant. Also, tangibility is negatively related with the earnings management with coefficient values of -0.2394 and p-value of 0.0459 which is significant at 5% level of significance. Firm size has negative relationship with earnings management of listed oil and gas firms in Nigeria with coefficient of -0.2382 and p-value of 0.0470 which is statistically significant at 5% level of significance. In contrast, firm age has insignificant positive relationship with earnings management with the coefficient of 0.1024 and p-value of 0.3989.

The relationship of the independent variables among themselves shows that firm size and tangibility, firm age and tangibility, and firm age and firm size are positively correlated among themselves. On the other hand, the relationship between tangibility and leverage, firm size and leverage, and firm age and leverage are negatively related among themselves.

4.2 Regression Results

In view of the nature of the data, Multicollinearity test was conducted and the test revealed a tolerance value and variance inflation factor of less than 1 and 10 respectively. This show complete absent of multicollinearity problem in the data of the study. Similarly, both fixed effect and random effect models were tested, Breusch and Pagan Lagrangian Multiplier test was conducted for the random effect in order to establish whether there is panel effect between the variables to warrant the use of Generalized Least Square or not. The Breusch and Pagan Lagrangian Multiplier test for random effect revealed a χ^2 value of 0.02 with p-value of 0.8853 which is not statistically significant as per the result attached in appendix (I). In the absence of significant level of Lagrangian Multiplier test, Robust Ordinary Least Square model was adopted for the study. Table 4.3 presents the summary of the robust ordinary least square regression results obtained from the analysis of data.

Table 4.3 Regression Results

Variables	Coefficient	T-Value	P-Value	Tolerance	VIF
Constant	0.5816	2.67	0.010		
LVG	-0.1584	-1.01	0.318	0.9552	1.05
TGB	-0.2606	-2.27	0.027	0.8759	1.14
FS	-0.0182	-1.93	0.057	0.9163	1.09
FAG	0.0023	1.82	0.073	0.9018	1.11
Adjusted R²	0.1390				
Wald Chi²	2.94				
Prob. Chi²			0.0024		

Source: Stata Output, 2016

Table 4.3 shows the functional relationship between dependent and independent variables as follows: **EM= 0.5816 - 0.1584LVG - 0.2606TGB – 0.0182FS + 0.0023FAG**

Table 4.3 shows that leverage has insignificant negative impact on earnings management of listed oil and gas firms in Nigeria. Meaning that, leverage is reducing the level of earnings management of the firms. This can be observed from the coefficient of -0.1584 and p-value of 0.318 which is statistically not significant at any level of significance. This finding is in line with that of Arise (2015) but inconsistent with Januarsi, Badina and Febrianti (2014).

Also, from table 4.3, tangibility is significantly and negatively correlated with earnings management of listed oil and gas firms in Nigeria which means tangibility is decreasing the level of earnings management of the firms. The coefficient of is -0.2606 with p-value of 0.027 which is statistically significant at 5% level of significance. The finding is in consistent with the study of Kim, Yura and Song (2013) but contradicted the findings of Bizjak, Hayes and Kalpathy (2014)

Furthermore, the result provides evidence of a significant negative association between firm size and earnings management of listed oil and gas firms in Nigeria. This implies that firm size is curtailing the level of earnings management of the companies. The result shows a coefficient of -0.0182 with p-value of 0.057 which is significant at 10% level of significance. The result is in line with the findings of Hamza and Lakhali (2010) who found evidence of negative significant relationship between firm size and earnings management.

Table 4.3 shows that firm age has significant positive influence on earnings management of listed oil and gas firms in Nigeria. This signifies that firm age is increasing the level of earnings management of the firms. The value of beta coefficient is 0.0023 while the corresponding p-value is 0.073, which is significant at 10% level of significance. This result is consistent with the findings of Demers and Wang (2010).

The combined and overall effect of the predictor variables on the explained variable showed that the model is adequate and free from misspecification. The Wald Chi² value of 2.94 with p-value of 0.0270 which is significant at 5% level of significance shows that the model is well fitted with the variables of the study. Also, the coefficient of determination or adjusted R² which stands at 14% indicates the proportion of the total variations in earnings management variable that is explained by the independent variables. This signifies that 14% of the total

variation in earnings management of listed oil and gas firms in Nigeria is caused by the combined effect of leverage, tangibility, firm size, and firm age; while the remaining 86% is caused by other factors outside the model of this study.

5.1 Conclusions and Recommendations

This study investigates the impact of corporate structure on earnings management of listed oil and gas companies in Nigeria. Data were collected from the annual reports and accounts of seven oil and gas firms in Nigeria, and analyzed using multiple regression. It was found that leverage; tangibility and firm size have negative relationship with earnings management of listed oil and gas firms in Nigeria, while firm age is found to have significant positive impact. This signifies that leverage, tangibility and firm size are reducing the level of earnings management activities, while firm age is increasing the earnings management practice in the company. It is recommended that the listed oil and gas firms in Nigeria should increase the percentage of leverage in their capital structure and also increase their investment on fixed assets as well as expanding the size of their operations, since the result reveals evidence that leverage, tangibility and firm size have negative influence on earnings management, meaning that leverage, tangibility and firm size are reducing the level of earnings management of the firms. Also, as long as the firms are continue to operate; proper monitoring mechanisms should be put in place in order to checkmate the activities of management, since firm age is influencing earnings management positively.

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 1. (/m# option or -set memory-) 1.00 MB allocated to data
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. edit
 (7 vars, 70 obs pasted into editor)
 - preserve

. su em lvg tgb fs fag, detail

EM

	Percentiles	Smallest		
1%	.0012885	.0012885		
5%	.0165938	.0053452		
10%	.0286642	.0095504	Obs	70
25%	.0480028	.0165938	Sum of wgt.	70
50%	.0982789		Mean	.1417705
75%	.1755916	Largest	Std. Dev.	.1374538
90%	.3155259	.377	Variance	.0188936
95%	.377	.5708945	Skewness	1.914257
99%	.6491852	.6236	Kurtosis	6.896722
		.6491852		

LVG

	Percentiles	Smallest		
1%	.5017	.5017		
5%	.5977	.5465		
10%	.62005	.5955	Obs	70
25%	.6816	.5977	Sum of wgt.	70
50%	.76515		Mean	.7510471
75%	.8074	Largest	Std. Dev.	.0929501
90%	.86295	.8789	Variance	.0086397
95%	.8789	.9158	Skewness	-.4154349
99%	.9489	.9189	Kurtosis	2.781487
		.9489		

TGB

	Percentiles	Smallest		
1%	.0587	.0587		
5%	.0694	.0658		
10%	.0814	.0679	Obs	70
25%	.1382	.0694	Sum of wgt.	70
50%	.23515		Mean	.2467329
75%	.325	Largest	Std. Dev.	.1306164
90%	.4552	.5006	Variance	.0170606
95%	.5006	.5206	Skewness	.5699882
99%	.5658	.5273	Kurtosis	2.548807
		.5658		

FS

	Percentiles	Smallest		
1%	13.787	13.787		
5%	14.124	13.847		
10%	14.605	13.908	Obs	70
25%	16.4342	14.124	Sum of wgt.	70
50%	17.54305		Mean	17.18233
75%	18.085	Largest	Std. Dev.	1.626053
90%	19.1146	19.8209	Variance	2.644049
95%	19.8209	20.0598	Skewness	-.4207286
99%	20.606	20.1878	Kurtosis	2.762897
		20.606		

FAG

. pwcorr em lvg tgb fs fag, star (0.05) sig

	em	lvg	tgb	fs	fag
em	1.0000				
lvg	-0.0854 0.4820	1.0000			
tgb	-0.2394* 0.0459	-0.1583 0.1907	1.0000		
fs	-0.2382* 0.0470	-0.0710 0.5592	0.2614* 0.0288	1.0000	
fag	0.1024 0.3989	-0.1755 0.1462	0.2554* 0.0328	0.1857 0.1237	1.0000

. reg em lvg tgb fs fag

Source	SS	df	MS	Number of obs =	70
Model	.181244225	4	.045311056	F(4, 65) =	2.62
Residual	1.12241136	65	.017267867	Prob > F =	0.0426
Total	1.30365558	69	.018893559	R-squared =	0.1390
				Adj R-squared =	0.0860
				Root MSE =	.13141

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
em					
lvg	-.1584422	.1741334	-0.91	0.366	-.5062106 .1893263
tgb	-.2606868	.1294056	-2.01	0.048	-.5191275 -.002246
fs	-.0182438	.0101631	-1.80	0.077	-.038541 .0020534
fag	.0023644	.0015326	1.54	0.128	-.0006964 .0054252
_cons	.581611	.2203819	2.64	0.010	.1414779 1.021744

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of em

chi2(1) = 9.99

Prob > chi2 = 0.0016

. vif

Variable	VIF	1/VIF
tgb	1.14	0.875968
fag	1.11	0.901876
fs	1.09	0.916357
lvg	1.05	0.955269
Mean VIF	1.10	

. xtset id year, yearly
 panel variable: id (strongly balanced)
 time variable: years, 2006 to 2015
 delta: 1 year

. xtreg em lvg tgb fs fag, fe

Fixed-effects (within) regression
 Group variable: id

R-sq: within = 0.1758
 between = 0.0656
 overall = 0.0155

Number of obs = 70
 Number of groups = 7

obs per group: min = 10
 avg = 10.0
 max = 10

corr(u_i, Xb) = -0.7883

F(4, 59) = 3.15
 Prob > F = 0.0206

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
em					
lvg	-.1615354	.1906853	-0.85	0.400	-.5430958 .2200249
tgb	-.245448	.147842	-1.66	0.102	-.5412793 .0503832
fs	-.029905	.0108134	-2.77	0.008	-.0515425 -.0082675
fag	-.0065614	.0054792	-1.20	0.236	-.0175252 .0044024
_cons	.9955256	.2984987	3.34	0.001	.3982312 1.59282
sigma_u	.12163802				
sigma_e	.12672222				
rho	.47953752				

(fraction of variance due to u_i)

F test that all u_i=0: F(6, 59) = 1.82 Prob > F = 0.1115

Corporate Structure and Earnings Management of Listed Oil and Gas Firms in Nigeria

```
. xtreg em lvg tgb fs fag, re
```

```
Random-effects GLS regression           Number of obs   =    70
Group variable: id                     Number of groups  =     7

R-sq:  within = 0.1390                  Obs per group: min =    10
      between = 0.1261                  avg           =   10.0
      overall  = 0.1356                  max           =    10

Random effects u_i ~ Gaussian           Wald chi2(4)      =   10.32
corr(u_i, X)      = 0 (assumed)        Prob > chi2       =   0.0354
```

	em	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
	lvg	-.1476457	.1788189	-0.83	0.409	-.4981244	.202833
	tgb	-.2342986	.1343837	-1.74	0.081	-.4976859	.0290887
	fs	-.0218846	.0102447	-2.14	0.033	-.0419638	-.0018053
	fag	.0019002	.0019535	0.97	0.331	-.0019285	.0057289
	_cons	.6407294	.2270068	2.82	0.005	.1958043	1.085654
	sigma_u	.03873528					
	sigma_e	.12672222					
	rho	.08545061	(fraction of variance due to u_i)				

```
. est store fixed
```

```
. est store random
```

```
. hausman fixed random
```

Note: the rank of the differenced variance matrix (0) does not equal the number of coefficients being tested (4); be sure this is what you expect, or there may be problems computing the test. Examine the output of your estimators for anything unexpected and possibly consider scaling your variables so that the coefficients are on a similar scale.

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random		
lvg	-.1476457	-.1476457	0	0
tgb	-.2342986	-.2342986	0	0
fs	-.0218846	-.0218846	0	0
fag	.0019002	.0019002	0	0

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

```
chi2(0) = (b-B)'[(V_b-V_B)^(-1)](b-B)
        = 0.00
Prob>chi2 = .
(V_b-V_B is not positive definite)
```

```
. xttest0
```

Breusch and Pagan Lagrangian multiplier test for random effects

```
em[id,t] = Xb + u[id] + e[id,t]
```

Estimated results:

	Var	sd = sqrt(Var)
em	.0188936	.1374538
e	.0160585	.1267222
u	.0015004	.0387353

Test: Var(u) = 0

```
chi2(1) = 0.02
Prob > chi2 = 0.8853
```

```
. reg em lvg tgb fs fag, robust
```

```
Linear regression           Number of obs   =    70
                             F( 4, 65) = 2.94
                             Prob > F   = 0.0270
                             R-squared   = 0.1390
                             Root MSE = .13141
```

	em	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
	lvg	-.1584422	.1575893	-1.01	0.318	-.4731697	.1562854
	tgb	-.2606868	.1150851	-2.27	0.027	-.4905275	-.030846
	fs	-.0182438	.0094338	-1.93	0.057	-.0370844	.0005967
	fag	.0023644	.0012977	1.82	0.073	-.0002274	.0049562
	_cons	.581611	.2177868	2.67	0.010	.1466607	1.016561

```
.
```