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**Article**

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Original Research Article

# Moderating Effect of Audit Quality on Corporate Attributes and Financial Performance of Listed Manufacturing Firms in Nigeria

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**Abstract**

*Most of the previous studies on organisational attributes and financial performance of firms examined the direct relationship without examining the indirect relationship with the financial performance of firms. This paper examined the moderating effect of audit quality on corporate attributes and financial performance of listed manufacturing firms in Nigeria for the period 2004 to 2018. Secondary data was obtained from a population of six manufacturing firms through their annual reports and accounts. Corporate attributes as an independent variable were proxied by leverage, liquidity and tangibility as well as audit quality used as moderating variable.*

*In contrast, the return on assets was used to represent financial performance as the dependent variable of the study. The study adopted a random effect multiple regression techniques in analyzing the data. The findings revealed that leverage has a significant positive impact on financial performance, liquidity and tangibility has insignificant negative impact on the financial performance of the firms, while the joined interaction of leverage and audit quality as moderating variable of the study has a significant negative effect on the financial performance of the firms. It is recommended that the firms should increase the level of leverage in their company since it was found that leverage has a significant positive relationship with the firms' financial performance as well as proper liquidity and non-current assets management.*

***Keywords:*** Leverage, Liquidity, Tangibility, Audit Quality and Financial Performance

***JEL Classification Codes: M400, M420***



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## 1. Introduction

Firm's financial performance is the measurement of the results of a company's strategies, policies and operations in monetary term. Mirza and Javed (2013) viewed firms' performance as the ability of a company to achieve its objectives using its available resources. Leverage is the debt component of firm capital structure which they used to finance their operations for business expansion, acquisitions of assets and working capital management within a particular accounting period. Liquidity represents the amount of cash or current assets that can easily be converted to cash for the daily operations of a company. Tangibility refers to the fixed assets that the company required for its day-to-day operations in other to make a profit for better financial performance at the end of its accounting period.

Extant literature on corporate attributes and financial performance of companies in Nigeria and other countries of the world examined only the direct relationship among the variables of the study (Abbas, Bashir, Manzoor,& Akram, 2013, Birru, 2016, Ojo, 2012, and Olarewaju & Adeyemi, 2015). This creates a gap for further research by introducing audit quality as moderating variable to examine the indirect relationship between corporate attributes and financial performance of listed manufacturing firms in Nigeria for a period beyond the 2017 financial year. Since, after the 2008 to 2009 financial crisis, manufacturing firms in Nigeria are finding it difficult to raise capital through equity financing in the capital market, this necessitates them to increase the level of leverage in their capital structure for them to survive in the business. The significant contribution of manufacturing firms to the Nigerian economy has made manufacturing firms a vital sector to be studied in the country. Therefore, this study seeks to examine the moderating effect of audit quality on corporate attributes and financial performance of listed manufacturing firms in Nigeria.

Following the introduction, section two focuses on the review of the existing literature. Section three addresses the methodology with an emphasis on the research design, theoretical framework and model specification. Section four presents the estimation results and discussion of findings and section five presents the conclusion and recommendation.

## 2. Review of Empirical Studies and Theoretical Framework

### Leverage and Financial Performance

Empirical literature were reviewed from the previous studies on the relationship between leverage and financial performance of firms such as the work of Getahun (2016) who studied the effect of capital structure on the financial performance of insurance companies in Ethiopia using a sample size of 9 insurance companies out of the population of 17 firms for the period of 2004 to 2013 and found a significant negative relationship between leverage and financial performance of the companies. Another study was conducted by Mule and Mukras (2015) on the relationship between financial leverage and financial performance of listed firms in Kenya for the period of 2007 to 2011 using a sample size of 47 firms. The finding of the study reveals a significant association between leverage and financial performance of the firms.

Similarly, Abbas, Bashir, Manzoor, and Akram (2013) examined the impact of determinants of financial performance of listed firms in Pakistan for the period of 2005 to 2010 using sample size of 139 firms out of the population of 164 firms and the result shows evidence of insignificant negative correlation between leverage and financial performance of the selected firms. Birundu (2014) explored the effect of capital structure on financial performance of small and medium enterprises in Kenya using the sample size of 40 firms for the period of 2009 to 2013 and found negative insignificant relationship between leverage and financial performance of the firms. Bhattarai (2016) examined the impact of capital structure on the financial performance of manufacturing firms in Nepalese using the sample size of 8 companies from 2004 to 2014. The result of the analysis reveals evidence of a significant negative relationship between leverage and financial performance of the companies.

Sudiyatno, Elen, and Kartika (2012) investigated company policy, firm performance and firm value using listed manufacturing firms in the Indonesian Stock Exchange from 2008 to 2010, and found a significant negative effect of leverage on firm financial performance. Their findings are in line with the results of Salehi (2009) who conducted a research on leverage and financial performance of some selected Iranian companies and found that leverage has a significant negative impact on firm performance. Earlier, Rayan (2008) documented that financial leverage has a significant negative effect on a firm's financial performance. Firms with low financial leverage tend to perform better than the firm with high financial leverage (Tan, 2009). Yoon and Jang (2005) studied the effect of financial leverage on profitability and risk of restaurant firms from 1998 to 2003. They found that firms that used the equity in financing their operations perform better than those firms that used leverage to fund their operations. Damouri, Khanagha, and Kaffash (2013) studied the relationship between changes in the financial leverages and the values of the listed firms in the Tehran Stock Exchange, using a sample of 98 firms from 2001 to 2010. Their results showed that there is no significant relationship between changes in the financial leverages and the financial performance of the selected firms.

Similarly, Fosu (2013) studied the relationship between capital structure and firm performance using panel data consisting of 257 South African companies for the period of 1998 to 2009 and found that financial leverage has a positive and significant effect on a firm's performance.

Low level of leverage can lead to an increase in profit, efficiency as well as firm performance. In contrast, a high degree of leverage can lead to a decrease in profit efficiency as well as a decrease in firm performance (Skopljak & Luo, 2012). Similarly, Hsu (2013) reported that leverage has a negative effect on the performance of 336 Information Technology companies in Taiwan. Onimisi (2010) examined the effect of capital structure on the performance of listed manufacturing firms in Nigeria and found a positive relationship between leverages and financial performance of Nigerian listed manufacturing firms. Likewise, Pachori and Totala (2012) examined the influence of financial leverage on shareholders returns and market capitalization in India. They found that there is no significant influence of financial leverage on shareholders' returns and market capitalization.

Rehman (2013) investigated the relationship between financial leverage and financial performance of listed sugar companies in Pakistan and found a significant positive relationship between leverage and firms financial performance. Akhtar, Javed, Maryam, and Sadia (2012) reported a significant positive relationship between leverage and the financial performance of listed fuel and energy companies in Pakistan. Ojo (2012) studied the effect of financial leverage on corporate performance of some selected companies in Nigeria and reported a significant effect between leverage and financial performance. However, Magpayo (2011) conducted a study on the relationship between leverage and financial performance, using a sample of 1000 companies in Philippine for one year (2009), and found a significant negative impact between leverage and the financial performance of the sampled firms.

**Liquidity and Financial Performance**

Museiga, Olweny, Mukanzi, and Mutua (2017) studied the effect of liquidity risk on the financial performance of commercial banks in Kenya from 2006 to 2015 using secondary data. The population of the study consists of 44 commercial banks in Kenya and 30 banks were used as the sample size of the study. Multiple regressions were used in analyzing the data, and the result reveals significant positive relationship between liquidity and financial performance of the firms. Olarewaju and Adeyemi (2015) examined the influence of liquidity on the financial performance of listed deposit money banks in Nigeria from 2004 to 2013 using the sample size of 15 banks. Secondary data was collected for the study and analyzed using multiple regressions, and the result of the analysis shows evidence of insignificant positive relationship between liquidity and financial performance of the banks. Pourali and Arasteh (2013) studied the relationship between liquidity, corporate governance and firm value and the results shows a significant positive relationship between liquidity and financial performance.

Also, Niresh (2012) examined the trade-off between liquidity and profitability of 31 listed firms in Sri Lanka for the period of 2007 to 2011. The result reveals a significant positive relationship between liquidity and profitability of the firms. Dalvi and Baghi (2014) explored the relationship between company performance and stock market liquidity, using a sample of 154 companies listed in Tehran Stock Exchange and found a strong positive association between liquidity and financial performance of firms. Owolabi and Obida (2012) examined the impact of liquidity management on the financial performance of listed manufacturing firms in Nigeria for

the period of 2005 to 2009, using a sample of 12 manufacturing firms. The result showed a significant positive impact of liquidity on the financial performance of the firms.

**Tangibility and Financial Performance**

Birru (2016) studied the effect of capital structure on the financial performance of commercial banks in Ethiopia for the period of 2011 to 2015 using a sample size of 9 banks which was arrived at using a purposive sampling technique. Multiple regression was used in analysing the secondary data collected for the study, and the result reveals evidence of significant negative association between tangibility and financial performance of the banks. Adamassu (2016) investigated the influence of capital structure on the financial performance of manufacturing companies in Ethiopia using the sample size of 15 firms from 2006 to 2012. Random Effect Generalized Least Square multiple regression was adopted for analyzing the secondary data collected for the study. The finding of the study shows an insignificant positive association between tangibility and financial performance of the firms. Pouraghajan, Malekian, Milad, Vida and Bagheri (2012) explored the effect of capital structure on the financial performance of listed companies in Tehran Stock Exchange for the period of 2006 to 2010 using the sample size of 400 firms. Multiple regressions was used as statistical tool of analysis of the secondary data collected for the study and found evidence of significant positive correlation between tangibility and financial performance of the firms.

Also, Mwangi and Birundu (2015) studied the effect of capital structure on the financial performance of 40 small and medium scale enterprises in Kenya for the period of 2009 to 2013 using multiple regressions as a tool of analysis of the secondary data collected for the study. The result of the investigation reveals an insignificant positive association between tangibility and financial performance of the firms. Bongoye, Banafa and Kingi (2016) examined the effect of firm-specific factors on the financial performance of non-financial companies listed in Nairobi Securities Exchange from 2011 to 2015. The study used the population and sample size of 37 firms, and multiple regressions was used in the analysis of the secondary data collected for the study. The result exhibited evidence of insignificant negative correlation between tangibility and financial performance of the firms.

## 3. METHODOLOGY

**Theoretical Framework and Model Specification**

The study of the relationship between corporate characteristics and organisational performance is anchored on the signaling theory of Spence (1973). The theory provides opportunity to communicate between two parties to a transaction on the reliability of the transaction. The theory is concerned with the reliability of some certain signal in terms of decision making. Signaling theory considered the quality and reliability of financial information sent by the firms to their users of financial information for decision making by investors. Spence (1973) state that a good performing firm differentiate itself from nonperforming one by sending good signal about its performance to capital markets and potential investors. Signals sent by company through its financial statement would inform the investors about their future financial performance. Also, signaling theory assumed that managers of a firm have more access to its financial information than the shareholders of a company. Signaling theory

is adopted in this study to underpin corporate attributes proxied by leverage, liquidity and tangibility as well as the financial performance proxied by return on assets.

**Model Specification**

Against the backdrop of the theoretical expousition and review of extant literature, we expect a functional relationship between corporate attributes and financial performance of the form:

ROA = f(LEV, LQT, TGY) ---------- (1)

*The functional form of equation 1 is transformed into econometric model as :*

$ROA_{it} = \beta_0 + \beta_1 LEV_{it} + \beta_2 LQT_{it} + \beta_3 TGY_{it} + \varepsilon_{it}$ …….. *(2)*

*Incorporating the moderating effect of Audit Quality into equation 2, we have:*

$ROA_{it} = \beta_0 + \beta_1 LEV_{it} + \beta_2 LQT_{it} + \beta_3 TGY_{it} + \beta_4 AQY_{it} + \beta_5 LEV*AQY_{it} + \beta_6 LQT*AQY_{it} + \beta_7 TGY*AQY_{it} + \varepsilon_{it}$ ---------- *(3)*

*Where: ROA is return on assets, a proxy for financial performance, $\beta_0$ is the intercept, LEV is leverage, LQT is liquidity, TGY is tangibility, LEV*AQY is the interaction between leverage and audit quality, LQT*AQY is the interaction between liquidity and audit quality, TGY*AQY is the interration between tangibility and audit quality, $\beta_1$ to $\beta_7$ are the unknown coefficients of the independent variables, i is the number of companies, and t is the period covered by the study.*

*It is presumptively expected that $\beta_1$ to $\beta_7 > 0$ based on theory and extant literature.*

Correlation research design is adopted because the study attempts to measure the relationship between corporate attributes and financial performance of listed manufacturing firms in Nigeria for the period of 2004 to 2018. The population of the study consists of all the listed manufacturing firms on the Nigerian Stock Exchange. Given the availability of data for six firms, the study adopted a random sampling approach by selecting six firms as a sample size of the study. The study used secondary data which was obtained from the annual reports and accounts of the six listed manufacturing firms in Nigeria for the period of the study. Generalized least square fixed effect multiple regression is adopted for the panel data analysis to establish the relationship among the variables of the study. Multiple regression was considered appropriate since it helps in not only establishing a relationship between the dependent and independent variables but also shows the cause and effect of their relationship.

**Operationalisation of Variables**

**Table 1: Variables Definition and Measurement**

| Variables Acronym | Variables Name | Variables Measurement and Source |
|---|---|---|
| | **Dependent Variable** | |
| **ROA** | Return on Assets | Measured as the profit before interest and tax divided by the firm's total assets (Mwangi & Birundu, 2015). |
| | **Independent Variables** | |
| **LEV** | Leverage | Measured as the ratio of long-term debt to the firm's total assets (Fosu, 2013). |

| | | |
|---|---|---|
| **LQT** | Liquidity | Measured as current assets divided by the firm's current liabilities (Niresh, 2012). |
| **TGY** | Tangibility | Measured as fixed assets divided by the firm's total assets (Birru, 2016) |
| | **Moderator** | |
| **AQY** | Audit Quality | Measured as natural logarithms of audit fees paid by the firms (Dalvi & Baghi, 2014). |

## 4. ESTIMATION RESULTS AND DISCUSSION OF FINDINGS

Some robustness tests like multicollinearity and heteroskedasticity tests were conducted to see their existence or otherwise. The multicollinearity analysis revealed a variance inflation factor and tolerance values of less than 10 and 1, respectively, meaning that the data used in the study do not have any problem of multicollinearity. The heteroskedasticity test revealed a $Chi^2$ value of 27.15 with a p-value of 0.000, which is significant at 1% level. This means there is heteroskedasticity problem associated with the data of the study. As a result of the existence of heteroskedasticity the study conducted fixed and random effect models tests and then Hausman test was used to decide which model to adopt. The result of the Hausman test reveals a $Chi^2$ value of 12.17 with a p-value of 0.09 which shows preference for the random effect model. Therefore, the study adopted the random effect regression for model 2 which has $R^2$ of 0.178 which is greater than the $R^2$ of 0.141 for model 1 of the study as well as the existence of a significant relationship of the joint effect of leverage and audit quality on the financial performance of listed manufacturing firms.

Table1 presents the summary of the random effect regression results obtained from the analysis of data in model 2 of the study.

**Table 2: Regression Results**

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| **Variables** | **Coefficient** | **P-Values** | **Coefficient** | **P-Values** |
| **Constant** | -0.146 | 0.010 | -0.024 | 0.934 |
| **LEV** | 0.176 | 0.048 | 0.713 | 0.035 |
| **LQT** | 0.058 | 0.051 | -0.126 | 0.512 |
| **TGY** | 0.076 | 0.350 | -0.077 | 0.875 |
| **AQY** | | | -0.006 | 0.679 |
| **LEV*AQY** | | | -0.032 | 0.085 |
| **LQT*AQY** | | | 0.011 | 0.322 |
| **TGY*AQY** | | | 0.008 | 0.769 |
| **$R^2$** | 0.141 | | 0.179 | |
| **Wald $Chi^2$** | 4.45 | 0.006 | 2.39 | 0.028 |
| **Hettest** | 18.08 | 0.000 | 27.15 | 0.000 |
| **Hausman** | 52.28 | 0.000 | 12.17 | 0.095 |

***Source: Stata Output, 2020***

Table 2 shows that leverage has a significant positive impact on the financial performance of listed manufacturing firms in Nigeria. This can be observed from the computed value of the beta coefficient of 0.713 with a p-value of 0.035, which is statistically significant at 5% level. It shows that as leverage rises, financial performance increases, this finding is in line with that of Mule and Mukras (2015) but inconsistent with Getahun (2016).

Table 2 reveals that liquidity is insignificant and negatively correlated with the financial performance of listed manufacturing firms in Nigeria. The coefficient of the variable is -0.126 with a p-value of 0.512, which is statistically insignificant at any level of significance. This implies that liquidity is decreasing the financial performance of manufacturing firms in Nigeria. The finding is inconsistent with the study of Museiga *et al.* (2017) but contradicts Olarewaju and Adeyemi (2015).

Furthermore, the result provides evidence of an insignificant negative association between tangibility and financial performance of listed manufacturing firms in Nigeria. The result shows a coefficient of -0.077 with a p-value of 0.875, which is insignificant. This signifies that tangibility is decreasing the financial performance of manufacturing firms in Nigeria. The result is in line with the findings of Pouraghajan *et al.* (2012) but contradicts Birru (2016).

Also, the result shows an insignificant negative relationship between audit quality as a moderating variable with the financial performance of listed manufacturing firms in Nigerian. This can be observed from the coefficient of -0.006 with p-value of 0.679, which implies that audit quality is reducing the financial performance of the selected manufacturing firms in Nigeria at an insignificant level.

In addition, the interaction of leverage and audit quality has significant negative relationship with the financial performance of listed manufacturing firms in Nigeria, based on the beta coefficient of -0.032 with the p-value of 0.085 which is significant at 10% level. This means the interaction of leverage and audit quality of the manufacturing firms in Nigeria is reducing their financial performance.

Furthermore, the interaction of liquidity and audit quality of listed manufacturing firms in Nigeria has insignificant positive relationship with the firm's financial performance. This can be proved from the beta coefficient of 0.011 and p-value of 0.322 which is not significant; this signifies that the joint effect of liquidity and audit quality of listed manufacturing firms in Nigeria is increasing their financial performance, but at an insignificant level.

Finally, the result provides evidence of an insignificant positive association between moderating variables tangibility and audit quality; and financial performance of listed manufacturing firms in Nigeria. The result shows a coefficient of 0.008 with a p-value of 0.769, which is insignificant at any level.

The Wald $Chi^2$ value of 2.39 with a p-value of 0.028, which is significant at 5% level shows that the model is well fitted with the variables of the study. Also, the coefficient of multiple determination ($R^{2)}$ which stands at 18% indicates the proportion of the total variations in the dependent variable that is explained by the independent variables. This signifies that 18% of the total variation in the financial performance of listed manufacturing firms in Nigeria is caused by

the combined effect of leverage, liquidity, tangibility and the moderating variables. In comparison, the remaining 82% is caused by other factors outside the model of this study.

## 5. CONCLUSION AND RECOMMENDATIONS

The study investigates the moderating impact of audit quality on corporate attributes and financial performance of listed manufacturing companies in Nigeria. It was concluded that leverage has significant positive influence on the financial performance of listed manufacturing firms in Nigeria. Liquidity and tangibility have negative and insignificant impact on the financial performance of the firms. The interaction of leverage and audit quality of the study is found to have a negative significant influence on the financial performance of listed manufacturing firms in Nigeria. It is recommended that the listed manufacturing firms in Nigeria should increase the level of leverage in their company since it was found that leverage has significant positive relationship with the firms' financial performance.

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## Appendix

**MODEL ONE**

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   13.0   Copyright 1985-2013 StataCorp LP
  Statistics/Data Analysis            StataCorp
                                      4905 Lakeway Drive
     MP - Parallel Edition            College Station, Texas 77845 USA
                                      800-STATA-PC        http://www.stata.com
                                      979-696-4600        stata@stata.com
                                      979-696-4601 (fax)

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      Serial number:  501306208483
        Licensed to:  MURTALA ABDULLAHI
                      KADUNA STATE UNIVERSITY

Notes:
     1.  (/v# option or -set maxvar-) 5000 maximum variables

. edit

. *(10 variables, 90 observations pasted into data editor)

. su roa lev lqt tgy aqy levaqy lqtaqy tgyaqy

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
         roa |        90    .0318778    .1268584       -.73        .31
         lev |        90    .4274167    .3142497        .01      .9189
         lqt |        90    1.244309    .5126244       .003      2.668
         tgy |        90    .3953333    .1724403       .108        .92
         aqy |        90    17.35471    3.164324     13.787     23.435
-------------+--------------------------------------------------------
      levaqy |        90    7.374746    5.598299   .1446817   18.88914
      lqtaqy |        90    21.50925    9.934408   .0565172   50.91152
      tgyaqy |        90    6.860919    3.180055   1.578275     14.061

. pwcorr roa lev lqt tgy aqy levaqy lqtaqy tgyaqy, star (0.05)

             |      roa      lev      lqt      tgy      aqy   levaqy   lqtaqy
-------------+---------------------------------------------------------------
         roa |   1.0000
         lev |   0.2056   1.0000
         lqt |   0.3439*  0.3770*  1.0000
         tgy |   0.1099   0.2764*  0.0385   1.0000
         aqy |  -0.1221  -0.0437  -0.0532   0.0001   1.0000
      levaqy |   0.1584   0.9548*  0.3898*  0.2314*  0.2021   1.0000
      lqtaqy |   0.2716*  0.3529*  0.8878*  0.0280   0.3890*  0.4836*  1.0000
      tgyaqy |   0.0420   0.2064   0.0085   0.8983*  0.4106*  0.2763*  0.1861

             |   tgyaqy
-------------+---------
      tgyaqy |   1.0000

. reg roa lev lqt tgy

      Source |       SS       df       MS              Number of obs =      90
-------------+------------------------------           F(  3,    86) =    4.32
       Model |  .187482962     3  .062494321           Prob > F      =  0.0069
    Residual |  1.24479951    86  .014474413           R-squared     =  0.1309
-------------+------------------------------           Adj R-squared =  0.1006
       Total |  1.43228247    89  .016093061           Root MSE      =  .12031

------------------------------------------------------------------------------
         roa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
       lev |   .0258731   .0456814     0.57   0.573    -.0649385    .1166848
       lqt |   .0783706   .0269327     2.91   0.005     .0248302    .1319111
       tgy |   .0588863   .0771632     0.76   0.447    -.0945091    .2122817
     _cons |  -.0999778   .0437075    -2.29   0.025    -.1868654   -.0130902
------------------------------------------------------------------------------

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
       Ho: Constant variance
       Variables: fitted values of roa

       chi2(1)      =    18.08
       Prob > chi2  =   0.0000

. vif

    Variable |       VIF       1/VIF
-------------+----------------------
       lev |      1.27    0.789191
       lqt |      1.17    0.853203
       tgy |      1.09    0.918571
-------------+----------------------
    Mean VIF |      1.18

. xtset id year, yearly
      panel variable:  id (strongly balanced)
       time variable:  year, 2004 to 2018
               delta:  1 year

. xtreg roa lev lqt tgy, fe

Fixed-effects (within) regression               Number of obs      =        90
Group variable: id                              Number of groups   =         6

R-sq:  within  = 0.1414                         Obs per group: min =        15
       between = 0.1308                                        avg =      15.0
       overall = 0.0921                                        max =        15

                                                F(3,81)           =      4.45
corr(u_i, Xb)  = -0.6303                        Prob > F          =    0.0061

------------------------------------------------------------------------------
       roa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lev |   .1760387   .0876521     2.01   0.048     .0016385     .350439
       lqt |   .0586591   .0296385     1.98   0.051    -.0003122    .1176303
       tgy |   .0768751   .0818156     0.94   0.350    -.0859122    .2396624
     _cons |  -.1467454   .0553002    -2.65   0.010    -.2567755   -.0367154
-------------+----------------------------------------------------------------
     sigma_u |  .06542625
     sigma_e |  .11689805
         rho |  .23852973   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
F test that all u_i=0:     F(5, 81) =     2.02                 Prob > F = 0.0847

. est store fixed

. xtreg roa lev lqt tgy, re

Random-effects GLS regression                   Number of obs      =        90
Group variable: id                              Number of groups   =         6

R-sq:  within  = 0.1163                         Obs per group: min =        15
       between = 0.2856                                        avg =      15.0
       overall = 0.1301                                        max =        15

                                                Wald chi2(3)       =     12.42
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0061

------------------------------------------------------------------------------
         roa |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lev |   .0393267   .0499695     0.79   0.431    -.0586117    .1372652
         lqt |   .0755042   .0273685     2.76   0.006     .0218628    .1291455
         tgy |   .0546259   .0773784     0.71   0.480    -.0970329    .2062848
       _cons |  -.1004771   .0452961    -2.22   0.027    -.1892557   -.0116984
-------------+----------------------------------------------------------------
     sigma_u |  .01907916
     sigma_e |  .11689805
         rho |  .02594697   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. est store random

. hausman fixed random

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
         lev |    .1760387     .0393267         .136712        .0720135
         lqt |    .0586591     .0755042       -.0168451        .0113756
         tgy |    .0768751     .0546259        .0222492        .0265777
------------------------------------------------------------------------------
                           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(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                           =       52.28
                 Prob>chi2 =      0.0000
```

**MODEL TWO**

```
. reg roa lev lqt tgy aqy levaqy lqtaqy tgyaqy

      Source |       SS       df       MS              Number of obs =      90
-------------+------------------------------           F(  7,    82) =    2.66
       Model |  .265436949     7  .037919564           Prob > F      =  0.0155
    Residual |  1.16684552    82  .014229823           R-squared     =  0.1853
-------------+------------------------------           Adj R-squared =  0.1158
       Total |  1.43228247    89  .016093061           Root MSE      =  .11929

------------------------------------------------------------------------------
         roa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lev |   .5685801   .2962429     1.92   0.058    -.0207414    1.157901
         lqt |  -.2304092   .1879979    -1.23   0.224    -.6043969    .1435785
         tgy |   .0376138   .4750021     0.08   0.937    -.9073168    .9825443
         aqy |  -.0153133   .0153353    -1.00   0.321    -.0458201    .0151935
      levaqy |  -.0331516   .0173883    -1.91   0.060    -.0677424    .0014393
      lqtaqy |   .0185829   .0109371     1.70   0.093    -.0031744    .0403403
      tgyaqy |   .0001435   .0276827     0.01   0.996    -.0549262    .0552132
       _cons |   .1702406   .2671543     0.64   0.526    -.3612144    .7016955
------------------------------------------------------------------------------

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of roa

         chi2(1)      =    27.15
         Prob > chi2  =   0.0000

. xtset id year, yearly
       panel variable:  id (strongly balanced)
        time variable:  year, 2004 to 2018
                delta:  1 year

. xtreg roa lev lqt tgy aqy levaqy lqtaqy tgyaqy, fe

Fixed-effects (within) regression               Number of obs      =        90
Group variable: id                              Number of groups   =         6

R-sq:  within  = 0.1787                         Obs per group: min =        15
       between = 0.1417                                        avg =      15.0
       overall = 0.1251                                        max =        15

                                                F(7,77)           =      2.39
corr(u_i, Xb)  = -0.5694                        Prob > F          =    0.0287

------------------------------------------------------------------------------
         roa |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lev |   .7139133   .3327447     2.15   0.035     .0513339    1.376493
         lqt |  -.1264486   .1919561    -0.66   0.512    -.5086821    .2557848
```

```
         tgy |  -.0774192    .488542    -0.16   0.875    -1.050231    .8953923
         aqy |  -.0068211   .0164088    -0.42   0.679    -.0394952     .025853
      levaqy |  -.0326236   .0186941    -1.75   0.085    -.0698484    .0046011
      lqtaqy |    .011161   .0112057     1.00   0.322    -.0111524    .0334745
      tgyaqy |   .0084112    .028589     0.29   0.769    -.0485167    .0653391
       _cons |  -.0241177   .2881088    -0.08   0.934    -.5978157    .5495803
-------------+----------------------------------------------------------------
     sigma_u |  .06192147
     sigma_e |  .11726243
         rho |  .21804515   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5, 77) =     1.57                 Prob > F = 0.1781

. est store fixed

. xtreg roa lev lqt tgy aqy levaqy lqtaqy tgyaqy, re

Random-effects GLS regression                   Number of obs      =        90
Group variable: id                              Number of groups   =         6

R-sq:  within  = 0.1501                         Obs per group: min =        15
       between = 0.5319                                        avg =      15.0
       overall = 0.1853                                        max =        15

                                                Wald chi2(7)       =     18.65
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0093

------------------------------------------------------------------------------
         roa |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lev |   .5685801   .2962429     1.92   0.055    -.0120453    1.149205
         lqt |  -.2304092   .1879979    -1.23   0.220    -.5988783    .1380599
         tgy |   .0376138   .4750021     0.08   0.937    -.8933733    .9686008
         aqy |  -.0153133   .0153353    -1.00   0.318    -.0453699    .0147433
      levaqy |  -.0331516   .0173883    -1.91   0.057     -.067232    .0009289
      lqtaqy |   .0185829   .0109371     1.70   0.089    -.0028534    .0400192
      tgyaqy |   .0001435   .0276827     0.01   0.996    -.0541136    .0544006
       _cons |   .1702406   .2671543     0.64   0.524    -.3533722    .6938533
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |  .11726243
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. est store random

. hausman fixed random

                ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |    fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
         lev |    .7139133     .5685801        .1453333         .151523
         lqt |   -.1264486    -.2304092        .1039606        .0387808
```

```
        tgy |   -.0774192     .0376138        -.115033        .1142204
        aqy |   -.0068211    -.0153133        .0084922        .0058376
     levaqy |   -.0326236    -.0331516         .000528        .0068642
     lqtaqy |    .011161     .0185829       -.0074219         .002439
     tgyaqy |    .0084112     .0001435        .0082677        .0071413
------------------------------------------------------------------------------
                     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(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       12.17
                Prob>chi2 =      0.0951
                (V_b-V_B is not positive definite)

.
```