

Audit Committee Characteristics and Financial Reporting Quality of Listed Consumer Goods Firms in Nigeria: Moderating Role of Institutional Ownership

Liman, Abubakar., Abubakar, Modibbo*

Department of Accounting, Federal University Birnin Kebbi, Nigeria

*Corresponding Author

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ABSTRACT

This study investigates the moderating effect of institutional ownership on the relationship between audit committee (AC) characteristics and financial reporting quality (FRQ) of listed consumer goods firms in Nigeria over the period 2014–2024. Motivated by persistent earnings management concerns in Nigeria’s corporate sector, the study draws on agency theory, stakeholder theory, and resource dependence theory to examine how internal governance mechanisms (audit committee attributes) interact with external governance mechanisms (institutional ownership) to influence financial reporting outcomes. The study employs a quantitative ex-post facto design. Using panel data from 17 consumer goods firms listed on the Nigerian Exchange (NGX), FRQ was proxied by the discretionary accruals estimated through the performance-adjusted Modified Jones Model (Kothari et al., 2005), while Panel regression analysis was conducted with robustness checks. Audit committee characteristics, size, independence, financial expertise, and meeting frequency were examined alongside institutional ownership as a moderator. The results reveal that audit committee independence, financial expertise, and meeting frequency significantly improve FRQ, while committee size has a positive but insignificant effect. Institutional ownership shows a direct positive effect on FRQ and significantly strengthens the influence of AC size and meeting frequency, but not independence or expertise. These findings demonstrate that institutional investors reinforce weaker internal governance attributes, whereas their incremental effect is limited when strong AC attributes already exist. The study concludes that both internal and external governance mechanisms are crucial for enhancing financial reporting transparency in Nigeria’s consumer goods sector. Theoretically, it validates agency and stakeholder theories by highlighting the complementary role of independent monitoring and institutional oversight. Practically, it provides evidence for regulators and boards to strengthen audit committee composition, improve disclosure of institutional shareholding, and promote active engagement between institutional investors and corporate boards. The study contributes to corporate governance literature by offering sector-specific evidence from an emerging market and by integrating institutional ownership into the audit committee–FRQ nexus.

Keywords: Audit Committee Characteristics; Financial Reporting Quality; Institutional Ownership; Corporate Governance; Nigeria

INTRODUCTION

Audit committees play a central role in safeguarding FRQ by overseeing firms’ financial disclosures and curbing opportunistic earnings management (EM). EM, defined as the intentional manipulation of reported earnings for managerial or strategic objectives, undermines transparency and investor confidence (Dechow et al., 2018). The effectiveness of AC depends largely on its attributes, such as independence, financial expertise, size, gender diversity, and diligence, which have been linked to different outcomes in monitoring managerial behavior (Sultana et al., 2019; Biswas et al., 2023). For instance, independent and financially expert members are better equipped to detect irregularities, while gender diversity has been associated with improved ethical standards and risk-averse oversight (Zalata et al., 2022; Kao et al., 2020).

Despite these governance mechanisms, EM remains prevalent, particularly in developing economies where weak institutions limit board effectiveness (Velte, 2020). In Nigeria, repeated corporate scandals and financial misstatements have heightened concerns about the credibility of firms' reports, especially in the consumer goods sector. This raises important questions about how effectively audit committee attributes can constrain EM in such contexts.

Institutional investors are often regarded as critical actors in strengthening corporate governance. Owing to their large ownership stakes, expertise, and long-term orientation, they are expected to demand higher accountability, thereby complementing the monitoring role of audit committees (La Porta et al., 2020; Cornett et al., 2021). However, empirical evidence is mixed: while some studies show that institutional investors strengthen oversight, others suggest that passive or short-term-oriented institutions may prioritize immediate returns over governance reforms (Elghuweel et al., 2017; Ajibola et al., 2022).

Much of the existing evidence originates from developed markets, leaving limited insights into how institutional ownership interacts with audit committee features to influence FRQ in emerging economies. In Nigeria, where regulatory enforcement is relatively weak and governance frameworks are still evolving, the moderating role of institutional shareholding remains underexplored. Reliable financial reporting is vital for investors, regulators, and other stakeholders, yet persistent EM practices continue to undermine the integrity of corporate reports, distort market signals, and erode investor trust (Adaramola et al., 2022; Li et al., 2024).

Against this backdrop, this study investigates whether institutional ownership enhances or weakens the relationship between audit committee characteristics and FRQ in Nigeria's consumer goods sector, a sector known for its competitiveness and vulnerability to earnings manipulation. Specifically, the study seeks to answer the following question:

To what extent do audit committee characteristics influence financial reporting quality in the context of earnings management, and how does institutional shareholding moderate this relationship among listed consumer goods firms in Nigeria? By addressing this gap, the study contributes to the literature on corporate governance in emerging markets and provides insights for regulators, policymakers, and investors seeking to improve FRQ.

Objectives of the Study

The main objective of the study is to examine the moderating effect of institutional ownership on the relationship between audit committee characteristics and the financial reporting quality of listed consumer goods firms in Nigeria. The specific objectives of the study are:

- i. To examine the impact of audit committee size on the financial reporting quality of listed consumer goods firms in Nigeria.
- ii. To examine the impact of audit committee independence on the financial reporting quality of listed consumer goods firms in Nigeria.
- iii. To examine the impact of audit committee financial expertise on the financial reporting quality of listed consumer goods firms in Nigeria.
- iv. To examine the impact of audit committee meetings on the financial reporting quality of listed consumer goods firms in Nigeria.
- v. To determine the moderating effect of institutional ownership on the relationship between audit committee characteristics and the financial reporting quality of listed consumer goods firms in Nigeria.

Hypotheses of the Study

The following hypotheses are formulated in null form for the study;

H01: Audit committee size has no significant impact on the financial reporting quality of listed consumer goods firms in Nigeria.

H02: Audit committee independence has no significant impact on the financial reporting quality of listed consumer goods firms in Nigeria.

H03: Audit committee financial expertise has no significant impact on the financial reporting quality of listed consumer goods firms in Nigeria.

H04: Audit committee meetings have no significant impact on the financial reporting quality of listed consumer goods firms in Nigeria.

H05: Institutional ownership has no significant moderating effect on the relationship between audit committee characteristics and financial reporting quality of listed consumer goods firms in Nigeria.

LITERATURE AND THEORETICAL REVIEW

The study is anchored on Agency theory and Resource dependence theory. The separation of ownership/control creates monitoring needs (Jensen & Meckling, 1976). An effective AC mitigates managerial discretion/EM via independent judgment, financial expertise, and diligent oversight, improving FRQ. Institutional investors (with resources and monitoring incentives) can further reduce agency problems or, if passive/short-term-oriented, dilute governance benefits. Resource dependence theory. Larger and more diverse ACs can supply advice, external linkages, and problem-solving capacity that bolster reporting systems. Yet beyond an efficient threshold, coordination costs may erode benefits, implying potential nonlinear (e.g., inverted-U) size effects.

Integrated framework. AC attributes (independence, expertise, meetings, gender, size) influence FRQ primarily through monitoring (agency) and advisory/resource channels. Institutional ownership is posited to strengthen these channels, amplifying the effect of strong ACs on FRQ by adding external discipline and information rights.

Across Nigerian studies, AC attributes often relate to lower earnings management (EM)/higher FRQ, but results vary by sector, measure, and period. Abubakar et al. (2015), studying 14 Nigerian banks between 2009 and 2013, found that AC size and financial expertise significantly reduced discretionary loan loss provisions, improving reporting credibility. AC independence, financial expertise, and diligence/meetings frequently show beneficial effects (e.g., Ojeka et al., 2015; Mbobo & Umoren, 2016; Sylvester & James, 2016; Haruna et al., 2021), though some work reports insignificant or mixed results (Moses et al., 2016; Madugba et al., 2021). Evidence on AC size is mixed, sometimes helpful via diversity/resources, other times harmful via coordination costs (Tanko & Siyanbola, 2019; Umobong & Ibanichuka, 2017). Gender diversity tends to enhance FRQ/curb EM (John & Ruth, 2020; Olowookere et al., 2021), though nonlinear patterns have been noted elsewhere. Kaoje, Alkali, and Modibbo (2023) investigated audit committee characteristics and earnings management in 150 Nigerian listed firms between 2014 and 2019. Using data from Thomson Reuters and annual reports, analyzed with Generalized Least Squares (GLS), they found that audit committee independence and meeting frequency were positively related to earnings management, while size, financial expertise, and firm size were negatively associated with it. In Nigeria, Modibbo (2016) analyzed 15 banks over 10 years (2004–2013) and found that governance mechanisms such as board independence and size positively affected cash flow manipulation, while AC size, independence, and financial expertise reduced such practices. Methodologically, many Nigerian studies rely on older windows (often ending 2014–2018), small samples, sector mixing, and OLS/correlation approaches with limited robustness, leaving room for updated designs and stronger identification.

Results are likewise mixed in foreign studies. Some studies find little contribution of board/AC mechanisms to FRQ (e.g., India: Faozi et al., 2018), while others show AC independence, financial expertise, gender diversity, and meetings constrain EM or audit report lag (Netherlands: Masmoudi & Makni, 2020; Masmoudi, 2021; Malaysia evidence is also mixed: Hasan et al., 2019; Suffian & Ghafar, 2021). A consistent theme is

measurement heterogeneity (accrual-based EM, real EM, audit report lag, Beneish M-score), which partly explains divergent findings. Evidence suggests IO often correlates with lower EM and stronger governance, but causality is contested. Some studies document moderating/strengthening effects of IO on AC effectiveness (e.g., Saudi Arabia: Ghazi, 2023), while others show selection rather than disciplining (institutions prefer already “cleaner” firms: Wang et al., 2021). In Nigeria, rigorous moderation tests of IO within consumer goods are not adequately investigated.

Prior studies generally support the monitoring role of ACs, especially independence, expertise, and diligence, but findings on size and gender diversity are context-dependent, reflecting differences in measurement and institutional settings. Evidence on institutional ownership suggests potential for added discipline, yet causality remains debated due to selection concerns. In Nigeria, the literature skews toward banks, mixes industries, and often stops at 2018, leaving consumer goods under-examined with limited moderation tests. Grounded in agency and resource-dependence perspectives, this study proposes that institutional investors amplify AC oversight, thereby reducing earnings manipulation and improving FRQ. By focusing on listed consumer goods firms, employing recent data and consistent FRQ metrics, and explicitly modeling AC×IO interactions, the paper addresses salient gaps and offers policy-relevant evidence for regulators and market participants.

METHODOLOGY

This study adopts a positivist research paradigm with a quantitative strategy, applying a correlational ex-post facto design that is suitable for examining cause-and-effect relationships in non-experimental settings. The approach is consistent with the study’s objective of determining how institutional ownership moderates the relationship between AC characteristics and FRQ in Nigerian listed consumer goods firms. A two-stage design is employed: in the first stage, FRQ is proxied by discretionary accruals estimated using the Modified Jones Model with performance adjustment (Kothari et al., 2005); in the second stage, panel regression is used to test the study’s hypotheses on the impact of AC characteristics and institutional ownership.

The population comprises 25 consumer goods firms (Table 1) listed on the Nigerian Exchange (NGX) as of December 31, 2024. After filtering for firms with consistent data across the study period (2014–2024), the effective sample includes 17 companies. Firms were excluded due to delisting, incomplete listing years, or recent listings within the study window. Secondary data were obtained from audited annual reports and accounts of the sampled firms, reflecting the positivist orientation and ensuring comparability with prior corporate governance studies.

Table 1: Population of the Study

SN	Company Name	NGX Sector	Year of Listing
1	Cadbury Nig. Plc	Consumer Goods	1976
2	Champion Brew. Plc	Consumer Goods	1983
3	Dangote Flour Mills Plc	Consumer Goods	2008
4	Dangote Sugar Refi. Plc	Consumer Goods	2008
5	BUA Foods Plc	Consumer Goods	2022
6	Flour Mill Nig. Plc	Consumer Goods	1979
7	DN Tyre & Rubber Plc	Consumer Goods	1970
8	Golden Guinea Brew. Plc	Consumer Goods	1979
9	Guinness Nigeria Plc	Consumer Goods	1965

10	Honeywell Flour Mills Plc	Consumer Goods	2009
11	International Brew. Plc	Consumer Goods	1995
12	Jos Int Brew. Plc	Consumer Goods	1975
13	PS Mandrid Plc	Consumer Goods	2004
14	Menichols Plc	Consumer Goods	2009
15	Multi-Trex Integrated Foods Plc	Consumer Goods	2010
16	National Salt Com. Plc	Consumer Goods	1992
17	Vitafoam Nig Plc	Consumer Goods	1973
18	Nigerian Brew. Plc	Consumer Goods	1973
19	Nestle Nigeria Plc	Consumer Goods	1979
20	Northern Nigeria Flour Mills Plc	Consumer Goods	1978
21	Nigerian Enamelware Plc	Consumer Goods	1991
22	Premier Brew. Plc	Consumer Goods	1980
23	PZ Cussons Nig Plc	Consumer Goods	1974
24	Unilever Plc	Consumer Goods	1973
25	Union Dicon Salt Plc	Consumer Goods	1993

Source: NXG (2024)

The sample size of the study consists of seventeen (17) Firms (see Table 2), which was arrived at using a filter. Five companies (Premier Breweries Plc, Golden Guinness Breweries Plc, Multi-Trex Food Plc, Jos Breweries Plc, and Dangote Flour Mills Plc) were not on the NGX lists for some years during the period covered by the study (2014-2024), and they were dropped. Similarly, BUA Foods Plc was listed on the NGX in 2024, while DN Tire and Rubber and P.S. Mandrid Plc were delisted from the exchange. Therefore, the study population becomes 17 firms, and hence constitutes the sample size of the study.

Table 2: Sample Size of the Study

SN	Company Name	NGX Sector	Year of Listing
1	Cadbury Nig. Plc	Consumer Goods	1976
2	Champion Brew. Plc	Consumer Goods	1983
3	Dangote Flour Mills Plc	Consumer Goods	2008
4	Flour Mill Nig. Plc	Consumer Goods	1979
5	Guinness Nigeria Plc	Consumer Goods	1965

6	Honeywell Flour Mills Plc	Consumer Goods	2009
7	International Brew. Plc	Consumer Goods	1995
8	Menichols Plc	Consumer Goods	2009
9	National Salt Com. Plc	Consumer Goods	1992
10	Vitafoam Nig Plc	Consumer Goods	1973
11	Nigerian Brew. Plc	Consumer Goods	1973
12	Nestle Nigeria Plc	Consumer Goods	1979
13	Northern Nigeria Flour Mills Plc	Consumer Goods	1978
14	Nigerian Enamelware Plc	Consumer Goods	1991
15	PZ Cussons Nig Plc	Consumer Goods	1974
16	Unilever Plc	Consumer Goods	1973
17	Union Dicon Salt Plc	Consumer Goods	1993

Source: Researcher

Panel regression techniques were employed for data analysis, complemented by robustness tests including normality, multicollinearity, heteroskedasticity, and the Hausman specification test to determine the appropriate model (fixed or random effects). Variables consist of FRQ as the dependent variable (measured by discretionary accruals), AC attributes as independent variables (independence, financial expertise, size, gender diversity, and meeting frequency), and institutional ownership as the moderating variable.

Table 3: Variables Measurement

Variable	Measurement	Expected Sign
Dependent		
Earnings Management (proxy of FRQ)	Measured by the absolute value of discretionary accruals extracted from the residuals of the Kothari et al. (2005) model.	NA
Independent		
Audit Committee Size (ACS)	This is measured by the total number of committee members at the end of the accounting period.	Significant positive (+ve)
Audit Committee Independent (ACI)	This is measured using the proportion of the non-executive independent directors in the committee at the end of the accounting period.	Significant positive (+ve)
Audit Committee Meetings (ACM)	This is measured using the total number of meetings held during the accounting period.	Significant positive (+ve)
Audit Committee Financial Expertise (ACX)	This score is 1 if AC consists of at least one member with a professional accounting qualification, and 0 otherwise.	Significant Negative (-ve)

Moderator			
Institutional Ownership (IOW)		Measured using the proportion of shareholding by institutions	Significant Negative (+ve)
Control			
Firm Size (FSZ)		Measured by the Natural Log of Total Assets	Significant Negative (-ve)

STATA software was used for analysis, and the Modified Jones Model was specifically applied to adjust for firm performance by including return on assets, thereby producing a more reliable measure of discretionary accruals as a proxy for earnings management and FRQ. The model, total accruals are defined as follows:

$$TAC_{it}/TA_{it-1} = \beta_0(1/TA_{it-1}) + \beta_2(\Delta REV_{it}-\Delta REC_{it}/TA_{it-1}) + \beta_3(\Delta PPE_{it}/TA_{it-1}) + \beta_4ROA_{it-1} + \epsilon_{it} \dots\dots\dots 1$$

Where

TAC_{it} = Total accruals of firm I in year t, measured as Net income minus Cash flow from operations

TA_{it-1} = Lag of total assets of firm I in year t

ΔREV_{it} = Changes in revenue of firm I in year t from current year to last year

ΔREC_{it} = Changes in receivables of firm I in year t from current year to last year

PPE_{it} = Property plant and equipment of firm I in year t at the end of the year

ROA_{it} = Return on assets of firm I in year t at the end of the year.

β_0 is the regression intercept, β_1 - β_4 are estimators, while ϵ_{it} is the residuals (absolute discretionary accruals-earnings management).

Therefore, the residuals of Model 1 represent the measure of FRQ (earnings management based on discretionary accruals). The models of the study are mathematically expressed as follows;

$$FRQ_{it} = \beta_0 + \beta_1ACS_{it} + \beta_2ACI_{it} + \beta_3ACX_{it} + \beta_4ACM_{it} + \beta_5IOW_{it} + \beta_6FSZ_{it} + \epsilon_{it} \dots\dots\dots 2$$

$$FRQ_{it} = \beta_0 + \beta_1ACS_{it} + \beta_2ACI_{it} + \beta_3ACX_{it} + \beta_4ACM_{it} + \beta_5IOW_{it} + \beta_7ACS_{it}*IOW_{it} + \beta_8ACI_{it}*IOW_{it} + \beta_9ACX_{it}*IOW_{it} + \beta_{10}ACM_{it}*IOW_{it} + \beta_6FSZ_{it} + \epsilon_{it} \dots\dots\dots 3$$

Where;

FRQ_{it} = Financial Reporting Quality of firm I in year t

ACS_{it} = audit committee size of firm I in year t

ACI_{it} = audit committee independent of firm I in year t

ACX_{it} = audit committee financial expertise of firm I in year t

ACM_{it} = audit committee meetings of firm I in year t

IOW_{it} = institutional ownership of firm I in year t

FSZ_{it} = Size of firm I in year t

β_0 is the regression intercept, β_1 - β_6 are estimators, while ε_{it} is the residuals

RESULTS AND DISCUSSION

Descriptive Statistics

The descriptive statistical analysis of the data obtained on the dependent, explanatory, control, and moderating variables of the study is presented in this sub-section. It provides the summary statistics of the data collected, which include mean, standard deviation, skewness, kurtosis, and minimum and maximum values of the variables. The descriptive statistics of the variables are presented in Table 4.

Table 4: Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum	Skewness	Kurtosis	Obs
FRQ	0.2300	0.1569	0.4197	0.4002	-0.5237	3.4418	187
ACS	5.5989	0.6175	4.0000	6.0000	-1.2731	3.5138	187
ACI	0.2008	0.0649	0.1300	0.4400	1.7594	6.7760	187
ACX	0.4919	0.5013	0.0000	1.0000	0.0321	1.0010	187
ACM	3.5615	0.6880	2.0000	5.0000	-0.0730	2.7929	187
IOW	15.011	2.7435	8.0000	23.000	-0.0786	3.6759	187
FSZ	17.160	2.3818	11.000	20.000	-0.9354	3.2108	187

Source: Results Output from STATA

The descriptive statistics in Table 4 show that the mean value of FRQ, measured as the inverse of discretionary accruals, is 0.2300 with a standard deviation of 0.1569. This indicates relatively high accrual quality among the sampled consumer goods firms. The distribution is negatively skewed (-0.5237) with a kurtosis of 3.4418, suggesting non-normality. Among AC attributes, the average ACS was 5 members ($SD = 0.6175$), consistent with the minimum provisions of CAMA 2020 and the Nigerian Code of Corporate Governance (2018), although some firms still fell below this benchmark. Independence (ACI) averaged 20.08% ($SD = 0.0649$), within the statutory requirement of at least two non-executive directors, but skewness (1.7594) and high kurtosis (6.7760) further confirm non-normal distribution.

Audit committee financial expertise (ACX) averaged 49.19% of members, below the CAMA 2020 requirement that at least one member possess a professional accounting qualification, while dispersion was wide ($SD = 0.5013$). Meeting frequency (ACM) averaged 3.56 per year ($SD = 0.6880$), indicating compliance with the quarterly minimum recommended by the governance code. Skewness and kurtosis values across AC variables generally indicate departures from normality, a common feature in corporate governance data. Institutional ownership (IOW), the moderating variable, averaged 15.01% ($SD = 2.7435$), ranging between 8% and 23%. This level of institutional participation suggests moderate but potentially influential shareholder monitoring capacity within the sector.

For the control variable, firm size (FSZ), proxied by the natural logarithm of total assets, averaged 17.16 with a wide dispersion ($SD = 2.3818$), reflecting the diverse asset bases of consumer goods firms. The minimum was 11, and the maximum was 20, again with a non-normal distribution (skewness 0.9354; kurtosis 3.2108). Overall, the descriptive results reveal that most variables deviate from normality, as confirmed by skewness

and kurtosis values. To formally test this, the Shapiro–Wilk test for normality was employed, with results presented in Table 5.

Table 5: Data Normality Test

Variables	W	V	Z	Prob>Z	Obs
FRQ	0.9697	4.2620	3.3240	0.0004	187
ACS	0.9531	6.5970	4.3260	0.0000	187
ACI	0.8497	21.145	6.9970	0.0000	187
ACX	0.9994	0.0760	5.9050	1.0000	187
ACM	0.9980	0.2820	2.9060	0.9981	187
IOW	0.9842	2.2190	1.8270	0.0338	187
FSZ	0.9385	8.6510	4.9480	0.0000	187

Source: Results Output from STATA

The Shapiro-Wilk test is a useful tool for testing normality. The null hypothesis principle is used in the Shapiro-Wilk (W) test for normal data; under the principle, the Null hypothesis that ‘the data is normally distributed’ is tested. Table 5 indicates that data from all the variables of the study are not normally distributed because the P-values are significant at a 1% and 5% level of significance (p-values of 0.0000 and 0.0338), except the ACX and ACM, which are not statistically significant at all levels of significance (p-values of 1.0000 and 0.9981). Therefore, the null hypothesis (that the data is normally distributed) is rejected for FRQ, ACS, ACI, IOW, and FSZ, while not rejected for the ACX and ACM. This may lead to problems in OLS regression, hence the need for panel regression models.

Table 6: Correlation Matrix

Variable	FRQ	ACS	ACI	ACX	ACM	IOW	FSZ
FRQ	1.0000						
ACS	0.1761**	1.0000					
ACI	0.1368*	-0.1580**	1.0000				
ACX	0.0851	0.0781	0.0540	1.0000			
ACM	0.6836***	0.0936	0.1057	0.0468	1.0000		
IOW	0.4281***	0.1210*	-0.3587***	-0.0177	0.4972***	1.0000	
FSZ	0.1595**	-0.1301*	0.1446**	0.1023	0.2100***	0.0411	1.0000

*Significant at 10%; **Significant at 5%; ***Significant at 1%;

Source: Results Output from STATA

The correlation results in Table 6 indicate that certain audit committee attributes are significantly associated with financial reporting quality (FRQ), proxied by discretionary accruals. Specifically, audit committee size

(ACS) shows a positive and significant relationship with FRQ ($r = 0.1761$, $p < 0.05$), suggesting that larger committees are linked with higher reporting quality. Similarly, audit committee independence (ACI) is positively related to FRQ ($r = 0.1368$, $p < 0.10$), implying that the inclusion of more independent non-executive directors in audit committees enhances oversight and improves accrual quality.

In contrast, audit committee financial expertise (ACX) is positively but insignificantly related to FRQ ($r = 0.0851$), indicating that although financial experts may contribute to monitoring, their presence alone does not significantly improve reporting quality within the sampled firms. By comparison, audit committee meeting frequency (ACM) demonstrates a very strong positive and highly significant association with FRQ ($r = 0.6836$, $p < 0.01$), underscoring the importance of regular meetings in curbing earnings management and enhancing transparency.

Institutional ownership (IOW) also shows a positive and significant relationship with FRQ ($r = 0.4281$, $p < 0.01$), suggesting that institutional investors play an important monitoring role in reducing earnings manipulation. The control variable, firm size (FSZ), is likewise positively related to FRQ ($r = 0.1595$, $p < 0.05$), implying that larger firms exhibit higher reporting quality. Finally, correlations among the independent variables are all below the 0.80 threshold, confirming the absence of multicollinearity concerns (Gujarati, 2003; Hair et al., 2006). This ensures that the independent variables can be reliably included in the regression models without distortion from high inter-variable correlations.

Regression Diagnostic Tests

Consistent with the classical regression assumptions, the study conducted some robustness tests to ensure the validity and reliability of all the statistical inferences as well as the findings of the study. The tests include Data Normality (Table 5), Heteroscedasticity, Multicollinearity, Model Specification Test, and Model Fit Test. When these assumptions are not met, the estimators are biased and cannot be used to draw any inference.

Tables 7: Regression Summary – Diagnostic

	Model 2 (Unmoderated Model)		Model 3 (Moderated Model)	
Variables	Coefficients	P-Value	Coefficients	P-Value
Hetest: Chi2	2.18	0.1394	2.32	0.1274
Mean VIF	1.31		1.33	
Omitted Variable Test	0.15	0.9280	0.40	0.7531
Linktest(hatsq)	-0.0749	0.854	-0.1152	0.764
Hausman Test: Chi2	80.30	0.0000	57.18	0.0000
R Squared (Overall)	0.4773		0.4603	
F-Statistic	45.96	0.0000	29.27	0.0000

Source: Results Output from STATA

The study measured financial reporting quality (FRQ) using the inverse of discretionary accruals estimated through the Modified Jones Model with performance adjustment (Kothari et al., 2005). Before estimation, diagnostic checks confirmed the robustness of the model: variance inflation factor (VIF) values were well below the threshold of 10 (mean VIF = 1.26), indicating no multicollinearity; the Breusch–Pagan test confirmed homoscedasticity ($\text{Chi}^2 = 0.01$, $p = 0.9085$); and the Ramsey RESET test ($\text{ovtest} = 0.08$, $p = 0.9713$) showed no evidence of omitted variable bias. The Hausman specification test favored the fixed-effects model ($\text{Chi}^2 = 27.98$, $p < 0.001$), and the regression was statistically significant ($F\text{-statistic} = 64.55$, $p < 0.001$), with

explanatory variables accounting for 45.87% of the variation in FRQ. These results validate the suitability of the model for subsequent hypothesis testing.

Further robustness tests confirmed that the models satisfied the assumptions of classical regression. The Breusch–Pagan/Cook–Weisberg test showed no evidence of heteroskedasticity in either Model 2 ($\text{Chi}^2 = 2.18$, $p = 0.1394$) or Model 3 ($\text{Chi}^2 = 2.82$, $p = 0.1274$). Variance inflation factors for the explanatory variables remained below 10 (mean VIF = 1.31 for Model 2 and 1.33 for Model 3), affirming the absence of multicollinearity. Together, these results indicate that the panel data regressions are free from distortions that could bias coefficient estimates.

Specification tests also supported the adequacy of the models. Ramsey RESET results showed no indication of functional misspecification for both Model 2 ($F = 0.15$, $p = 0.9280$) and Model 3 ($F = 0.40$, $p = 0.7531$). Similarly, linktest results revealed that while the predicted values ($\hat{y}$) were significant, the squared predictions ($\hat{y}^2$) were not ($p = 0.854$ and 0.764), confirming that no relevant variables were omitted and no irrelevant variables were included. Overall, the explanatory variables accounted for 47.73% of the variation in FRQ in Model 2 and 46.03% in Model 3, demonstrating that the models were well-specified and provided a good fit to the data. These findings justify the use of the estimated models for empirical analysis and hypothesis testing.

Regression Analysis and Hypothesis Testing

In this section, the regression results obtained are analyzed and interpreted to generate findings that address the research objectives. The results are presented in Table 8.

Tables 8: Fixed-Effect Regression Coefficients Model 2 & 3

Variables	Model 2 (Unmoderated Model)		Model 3 (Moderated Model)	
	Coefficients	P-Value	Coefficients	P-Value
ACS	0.1103	0.141	0.1141	0.134
ACI	1.3049	0.000	1.3786	0.000
ACX	0.2333	0.035	0.2175	0.053
ACM	0.0817	0.000	0.0728	0.000
IOW	0.0453	0.000	0.0482	0.000
ACS*IOW			0.4254	0.034
ACI*IOW			-0.0782	0.381
ACX*IOW			-0.0848	0.464
ACM*IOW			0.0186	0.046
FSZ	0.0361	0.642	-0.0481	0.573
CONSTANT	-0.3092	0.339	-0.1053	0.763

Source: Results Output from STATA

The unmoderated regression model (Model 2) examined the direct effects of audit committee (AC) characteristics on financial reporting quality (FRQ). The results show that AC size (ACS) has a positive but

statistically insignificant effect on FRQ ($\beta = 0.1103$, $p = 0.141$). Thus, H1 is not supported, indicating that merely increasing AC membership does not necessarily improve oversight. This is consistent with Alhassan et al. (2019) and Oyedokun et al. (2020), who reported similar insignificance, but contrasts with Tanko and Siyanbola (2019), who found size to enhance FRQ. From the perspective of agency theory, larger ACs should provide stronger monitoring, but coordination difficulties or inactive members may limit their effectiveness, aligning with resource dependence theory, which stresses the importance of diversity and expertise over sheer numbers.

Audit committee independence (ACI) exerts a strong positive and significant effect on FRQ ($\beta = 1.3049$, $p < 0.01$), supporting H2. This finding suggests that independent directors provide unbiased oversight, curb opportunistic reporting, and enhance transparency. It aligns with Mbobbo and Umoren (2016), Sylvester and James (2016), and Haruna et al. (2021), and is consistent with agency theory, which views independence as essential for mitigating conflicts of interest. Similarly, AC financial expertise (ACX) shows a positive and significant effect on FRQ ($\beta = 0.2333$, $p < 0.05$), supporting H3. This underscores the value of financial competence in detecting manipulative practices and resonates with Ojeka et al. (2015), Agwor and Onukogu (2018), and Alhassan et al. (2019). While this supports stakeholder theory's emphasis on producing decision-useful financial information, it contrasts with Madugba et al. (2021), who found expertise insignificant in Nigerian banks, highlighting possible sectoral differences. AC meeting frequency (ACM) also has a strong positive impact ($\beta = 0.0817$, $p < 0.01$), supporting H4. This result demonstrates that frequent meetings facilitate better monitoring and is consistent with Sylvester and James (2016), Oyedokun et al. (2020), and Kurawa and Ishaku (2020). The finding validates agency theory, which posits that diligent oversight constrains managerial opportunism.

Institutional ownership (IOW) has a significant positive direct effect on FRQ ($\beta = 0.0453$, $p < 0.01$), indicating that institutional investors serve as effective external monitors. This finding supports agency theory, as institutional shareholders pressure managers to act in line with owners' interests, and stakeholder theory, which sees them as representing broader accountability demands. The result concurs with Rizani et al. (2019) and Ghazi (2023), who documented the disciplining effect of institutional ownership.

The moderated regression model (Model 3) further reveals that institutional ownership strengthens the effects of AC size ($ACSIOW$, $\beta = 0.4254$, $p < 0.05$) and meeting frequency ($ACMIOW$, $\beta = 0.0186$, $p < 0.05$) on FRQ, but does not significantly moderate AC independence ($ACIIOW$, $\beta = -0.0782$, $p = 0.381$) or financial expertise ($ACXIOW$, $\beta = -0.0848$, $p = 0.464$). Thus, H5 is partially supported. These findings suggest that institutional investors amplify governance where internal structures are weaker (size and diligence), but add little incremental effect where ACs already possess strong qualities (independence and expertise). This nuanced outcome resonates with Ghazi (2023), who found institutional investors amplify certain governance mechanisms, and with Wang et al. (2021), who argued that institutions often prefer firms with stronger pre-existing governance. The result also integrates agency theory (external monitors reinforce internal oversight) and resource dependence theory (institutional investors contribute additional pressure and expertise).

Overall, the study validates the proposition that effective governance mechanisms both internal (audit committees) and external (institutional ownership) are critical to enhancing FRQ in Nigerian consumer goods firms. Independence, expertise, and diligence within ACs are key drivers of transparent reporting, while institutional ownership plays a complementary role, particularly by reinforcing weaker governance features. These findings confirm and extend prior studies in Nigeria and internationally, while offering context-specific evidence for emerging markets where regulatory enforcement remains relatively weak.

CONCLUSION AND RECOMMENDATION

This study investigated the moderating effect of institutional ownership on the relationship between audit committee (AC) characteristics and financial reporting quality (FRQ) of listed consumer goods firms in Nigeria over eleven years (2014–2024). By employing discretionary accruals as a proxy for FRQ, the study established that audit committee independence, financial expertise, and meeting frequency significantly improve the quality of financial reporting, while committee size shows a positive but statistically insignificant effect. Importantly, institutional ownership itself was found to exert a significant positive influence on FRQ

and to moderate the effects of certain AC characteristics. Specifically, institutional ownership strengthened the impact of audit committee size and meeting frequency on FRQ, but did not significantly alter the effects of independence and expertise, which were already strong drivers of reporting quality.

Overall, the findings provide robust evidence that effective governance in Nigerian consumer goods firms is driven by both internal mechanisms, such as the structure and composition of the audit committee, and external mechanisms, represented by the monitoring role of institutional investors. This reinforces the view that good governance requires not just compliance with regulatory codes, but also a substantive focus on the quality, competence, and engagement of audit committee members, as well as the active participation of institutional investors. The study, therefore, concludes that the integration of internal and external governance mechanisms is critical for curbing earnings management and enhancing financial reporting transparency in Nigeria's consumer goods sector. Based on the findings and conclusions, several recommendations are advanced. First, regulatory agencies such as the Financial Reporting Council of Nigeria (FRCN) and the Securities and Exchange Commission (SEC) should strengthen corporate governance codes to ensure the presence of a minimum number of independent non-executive directors on audit committees, mandate at least one member with a professional accounting or finance qualification, and require a minimum of quarterly audit committee meetings. Strengthening these provisions will improve the monitoring capacity of audit committees and promote credible financial reporting.

Second, regulators should enforce continuous professional education and capacity building for audit committee members, particularly in areas of financial reporting and audit practices. In addition, there should be institutionalized performance evaluations of audit committees, with results disclosed to shareholders to improve accountability. Third, given the significant role of institutional ownership in enhancing FRQ, the Nigerian Exchange Group (NGX) and the Corporate Affairs Commission (CAC) should require companies to disclose the identity, category, and percentage of institutional shareholders as well as the nature of their engagement with the board and audit committees. This enhanced disclosure framework would strengthen transparency and improve investor confidence.

Furthermore, policymakers should consider introducing incentive frameworks such as governance ratings, listing privileges, or tax reliefs to encourage firms that demonstrate strong institutional investor engagement and governance effectiveness. Regulators should also mandate annual "effectiveness audits" of audit committees, covering composition, independence, financial expertise, and meeting diligence, with results submitted alongside annual filings and disclosed in governance reports. At the board level, directors should ensure that experienced and independent professionals with financial expertise are appointed to audit committees, that meetings are held frequently with active participation, and that institutional shareholders are formally engaged to leverage their oversight capacity. Such steps would enhance both the internal governance capacity of audit committees and the external monitoring influence of institutional investors, thereby strengthening the credibility of financial reporting across the sector.

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APPENDICES

```
. xtset id year, yearly
      panel variable:  id (strongly balanced)
      time variable:  year, 2014 to 2024
              delta:  1 year
```

```
. sum frq acs aci acx acm iow fsz, detail
```

frq				
	Percentiles	Smallest		
1%	-.4135475	-.4196841		
5%	-.3141089	-.4135475		
10%	-.2097208	-.4103204	Obs	187
25%	-.0740145	-.3929391	Sum of Wgt.	187
50%	.0099236		Mean	-2.30e-10
		Largest	Std. Dev.	.1568828
75%	.1207651	.3131892		
90%	.1580618	.337024	Variance	.0246122
95%	.2324781	.3763602	Skewness	-.5237124
99%	.3763602	.400195	Kurtosis	3.441857

acs				
	Percentiles	Smallest		
1%	4	4		
5%	4	4		
10%	5	4	Obs	187
25%	5	4	Sum of Wgt.	187
50%	6		Mean	5.59893
		Largest	Std. Dev.	.6174862
75%	6	6		
90%	6	6	Variance	.3812892
95%	6	6	Skewness	-1.273149
99%	6	6	Kurtosis	3.513817

aci				
	Percentiles	Smallest		
1%	.13	.13		
5%	.13	.13		
10%	.13	.13	Obs	187
25%	.16	.13	Sum of Wgt.	187
50%	.19		Mean	.2008021
		Largest	Std. Dev.	.064906
75%	.22	.44		
90%	.27	.44	Variance	.0042128
95%	.33	.44	Skewness	1.759468
99%	.44	.44	Kurtosis	6.776021

acx				
	Percentiles	Smallest		
1%	0	0		
5%	0	0		
10%	0	0	Obs	187
25%	0	0	Sum of Wgt.	187
50%	0		Mean	.4919786
		Largest	Std. Dev.	.5012778
75%	1	1		
90%	1	1	Variance	.2512794
95%	1	1	Skewness	.0320897
99%	1	1	Kurtosis	1.00103

acm				
	Percentiles	Smallest		
1%	2	2		
5%	3	2		
10%	3	2	Obs	187
25%	3	2	Sum of Wgt.	187
50%	4		Mean	3.561497
		Largest	Std. Dev.	.6880031
75%	4	5		
90%	4	5	Variance	.4733483
95%	5	5	Skewness	-.0730271
99%	5	5	Kurtosis	2.79292

iow				
	Percentiles	Smallest		
1%	8	8		
5%	9	8		
10%	12	8	Obs	187
25%	14	8	Sum of Wgt.	187
50%	15		Mean	15.0107
		Largest	Std. Dev.	2.743495
75%	16	21		
90%	18	21	Variance	7.526767
95%	20	23	Skewness	-.0785577
99%	23	23	Kurtosis	3.67599

fsz				
	Percentiles	Smallest		
1%	11	11		
5%	12	11		
10%	13	11	Obs	187
25%	16	11	Sum of Wgt.	187
50%	18		Mean	17.16043
		Largest	Std. Dev.	2.381816
75%	19	20		
90%	20	20	Variance	5.673049
95%	20	20	Skewness	-.935402
99%	20	20	Kurtosis	3.210803

```
. swilk tac rev_rec ppe roa
```

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
tac	187	0.99562	0.616	-1.112	0.86683
rev_rec	187	0.91622	11.789	5.657	0.00000
ppe	187	0.62532	52.725	9.092	0.00000
roa	187	0.80672	27.199	7.574	0.00000

```
. reg tac rev_rec ppe roa
```

Source	SS	df	MS	Number of obs	=	187
Model	3.67664994	3	1.22554998	F(3, 183)	=	55.90
Residual	4.01219488	183	.021924562	Prob > F	=	0.0000
				R-squared	=	0.4782
				Adj R-squared	=	0.4696
Total	7.68884482	186	.041337875	Root MSE	=	.14807

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
tac					
rev_rec	.0961016	.0097902	9.82	0.000	.0767854 .1154177
ppe	.0088401	.0045737	1.93	0.055	-.0001839 .017864
roa	.0344186	.0767606	0.45	0.654	-.117031 .1858683
_cons	.5274828	.3104146	1.70	0.091	-.084969 1.139934

```
. hettest
```

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of tac

chi2(1) = 0.01

Prob > chi2 = 0.9085

```
. vif
```

Variable	VIF	1/VIF
rev_rec	1.40	0.716837
ppe	1.34	0.748646
roa	1.05	0.950571
Mean VIF	1.26	

```
. ovtest
```

Ramsey RESET test using powers of the fitted values of tac

Ho: model has no omitted variables

F(3, 180) = 0.08

Prob > F = 0.9713

```
. xtreg tac rev_rec ppe roa, fe
```

Fixed-effects (within) regression

Group variable: id

Number of obs = 187

Number of groups = 17

R-sq:

within = 0.5369

between = 0.4445

overall = 0.4587

Obs per group:

min = 11

avg = 11.0

max = 11

corr(u_i, Xb) = -0.5020

F(3,167) = 64.55

Prob > F = 0.0000

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
tac					
rev_rec	.1025072	.0135991	7.54	0.000	.0756589 .1293556
ppe	.0269037	.0065727	4.09	0.000	.0139273 .0398801
roa	.0824553	.0848376	0.97	0.332	-.0850371 .2499476
_cons	.0469239	.3460344	0.14	0.892	-.6362418 .7300897
sigma_u	.09683651				
sigma_e	.13239993				
rho	.34850751	(fraction of variance due to u_i)			

F test that all u_i=0: F(16, 167) = 3.87

Prob > F = 0.0000

```
. est store fixed
```

```
. xtreg tac rev_rec ppe roa, re
```

```
Random-effects GLS regression      Number of obs   =      187
Group variable: id                Number of groups =      17
```

```
R-sq:                               Obs per group:
    within = 0.5311                  min =      11
    between = 0.5223                  avg =     11.0
    overall = 0.4752                  max =      11
```

```
corr(u_i, X)   = 0 (assumed)        Wald chi2(3)     =     177.94
                                          Prob > chi2      =      0.0000
```

	tac	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
rev_rec		.0999399	.0110393	9.05	0.000	.0783032 .1215766
ppe		.014941	.0052216	2.86	0.004	.0047069 .0251751
roa		.055919	.0797185	0.70	0.483	-.1003264 .2121645
_cons		.3394008	.3233649	1.05	0.294	-.2943827 .9731842
sigma_u		.04288404				
sigma_e		.13239993				
rho		.09494869	(fraction of variance due to u_i)			

```
. est store random
```

```
. hausman fixed random
```

	—— Coefficients ——		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random		
rev_rec	.1025072	.0999399	.0025673	.0079417
ppe	.0269037	.014941	.0119627	.003992
roa	.0824553	.055919	.0265363	.0290236

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)
        =      27.98
Prob>chi2 =      0.0000
```

```
. xtreg tac rev_rec ppe roa, fe
```

```
Fixed-effects (within) regression      Number of obs   =      187
Group variable: id                    Number of groups =      17
```

```
R-sq:                               Obs per group:
    within = 0.5369                  min =      11
    between = 0.4445                  avg =     11.0
    overall = 0.4587                  max =      11
```

```
corr(u_i, Xb) = -0.5020              F(3,167)         =     64.55
                                          Prob > F         =      0.0000
```

	tac	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
rev_rec		.1025072	.0135991	7.54	0.000	.0756589 .1293556
ppe		.0269037	.0065727	4.09	0.000	.0139273 .0398801
roa		.0824553	.0848376	0.97	0.332	-.0850371 .2499476
_cons		.0469239	.3460344	0.14	0.892	-.6362418 .7300897
sigma_u		.09683651				
sigma_e		.13239993				
rho		.34850751	(fraction of variance due to u_i)			

```
F test that all u_i=0: F(16, 167) = 3.87                Prob > F = 0.0000
```

```
. predict r, residual
```

```
. swilk frq acs aci acx acm iow fsz
```

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
frq	187	0.96971	4.262	3.324	0.00044
acs	187	0.95312	6.597	4.326	0.00001
aci	187	0.84974	21.145	6.997	0.00000
acx	187	0.99946	0.076	-5.905	1.00000
acm	187	0.99800	0.282	-2.906	0.99817
iow	187	0.98423	2.219	1.827	0.03383
fsz	187	0.93852	8.651	4.948	0.00000

```
. pwcorr frq acs aci acx acm iow fsz, star (0.05) sig
```

	frq	acs	aci	acx	acm	iow	fsz
frq	1.0000						
acs	0.1761* 0.0159	1.0000					
aci	0.1368 0.0619	-0.1580* 0.0308	1.0000				
acx	0.0851 0.2467	0.0781 0.2879	0.0540 0.4626	1.0000			
acm	0.6836* 0.0000	0.0936 0.2027	0.1057 0.1499	0.0468 0.5246	1.0000		
iow	0.4281* 0.0000	0.1210 0.0989	-0.3587* 0.0000	-0.0177 0.8096	0.4972* 0.0000	1.0000	
fsz	0.1595* 0.0292	-0.1301 0.0760	0.1446* 0.0484	0.1023 0.1634	0.2100* 0.0039	0.0411 0.5765	1.0000

```
. reg frq acs aci acx acm iow fsz
```

Source	SS	df	MS	Number of obs	=	187
Model	3.93833926	6	.656389876	F(6, 180)	=	31.50
Residual	3.75050556	180	.020836142	Prob > F	=	0.0000
				R-squared	=	0.5122
				Adj R-squared	=	0.4960
Total	7.68884482	186	.041337875	Root MSE	=	.14435

frq	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
acs	.0996925	.0423676	2.35	0.020	.0160914 .1832936
aci	.5147951	.1893492	2.72	0.007	.1411655 .8884248
acx	.099063	.125098	0.79	0.429	-.1477842 .3459102
acm	.0851248	.0101608	8.38	0.000	.0650752 .1051745
iow	.0147335	.0050604	2.91	0.004	.0047481 .0247189
fsz	.0344536	.0763257	0.45	0.652	-.1161546 .1850618
_cons	.3141626	.312429	1.01	0.316	-.3023319 .9306572

```
. hettest
```

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of frq

chi2(1) = 2.18

Prob > chi2 = 0.1394

```
. vif
```

Variable	VIF	1/VIF
iow	1.72	0.581194
acm	1.58	0.632457
aci	1.35	0.741664
fsz	1.09	0.913706
acs	1.07	0.936094
acx	1.02	0.977424
Mean VIF	1.31	

```
. ovtest
```

Ramsey RESET test using powers of the fitted values of frq

Ho: model has no omitted variables

F(3, 177) = 0.15

Prob > F = 0.9280

```
. linktest
```

Source	SS	df	MS	Number of obs	=	187
Model	3.93902917	2	1.96951458	F(2, 184)	=	96.64
Residual	3.74981565	184	.020379433	Prob > F	=	0.0000
				R-squared	=	0.5123
				Adj R-squared	=	0.5070
Total	7.68884482	186	.041337875	Root MSE	=	.14276

frq	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_hat	1.166586	.9081915	1.28	0.201	-.6252222	2.958394
_hatsq	-.0749853	.40752	-0.18	0.854	-.878998	.7290275
_cons	-.0908261	.4997012	-0.18	0.856	-1.076707	.8950547

```
. xtreg frq acs aci acx acm iow fsz, fe
```

Fixed-effects (within) regression Number of obs = 187
Group variable: id Number of groups = 17

R-sq: Obs per group:
within = 0.6271 min = 11
between = 0.4037 avg = 11.0
overall = 0.4773 max = 11

corr(u_i, Xb) = -0.5959 F(6,164) = 45.96
Prob > F = 0.0000

frq	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
acs	.1102655	.0744976	1.48	0.141	-.0368327	.2573637
aci	1.304888	.2212213	5.90	0.000	.868079	1.741697
acx	.2332767	.1096108	2.13	0.035	.0168463	.4497071
acm	.0816604	.0127543	6.40	0.000	.0564766	.1068443
iow	.0453318	.0066546	6.81	0.000	.0321921	.0584714
fsz	.0360782	.0773547	0.47	0.642	-.1166614	.1888178
_cons	-.3091804	.3221087	-0.96	0.339	-.9451952	.3268343
sigma_u	.12099411					
sigma_e	.11989806					
rho	.50454986	(fraction of variance due to u_i)				

F test that all u_i=0: F(16, 164) = 6.06 Prob > F = 0.0000

```
. est store fixed
```

```
. xtreg frq acs aci acx acm iow fsz, re
```

Random-effects GLS regression Number of obs = 187
Group variable: id Number of groups = 17

R-sq: Obs per group:
within = 0.6158 min = 11
between = 0.5075 avg = 11.0
overall = 0.5047 max = 11

corr(u_i, X) = 0 (assumed) Wald chi2(6) = 215.92
Prob > chi2 = 0.0000

frq	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
acs	.0966966	.0517789	1.87	0.062	-.0047882	.1981814
aci	.8089959	.2043822	3.96	0.000	.4084141	1.209578
acx	.1562289	.1176363	1.33	0.184	-.0743341	.3867919
acm	.0854077	.0112402	7.60	0.000	.0633773	.1074382
iow	.0261501	.0057183	4.57	0.000	.0149424	.0373577
fsz	.0364425	.0774979	0.47	0.638	-.1154506	.1883355
_cons	.0750077	.3192553	0.23	0.814	-.5507212	.7007366
sigma_u	.04247809					
sigma_e	.11989806					
rho	.11152012	(fraction of variance due to u_i)				

```
. est store random
```

```
. hausman fixed random
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random		
acs	.1102655	.0966966	.0135689	.0535616
aci	1.304888	.8089959	.4958923	.0846568
acx	.2332767	.1562289	.0770478	.
acm	.0816604	.0854077	-.0037473	.0060275
iow	.0453318	.0261501	.0191817	.0034036
fsz	.0360782	.0364425	-.0003643	.

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(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 80.30
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

```
. reg frq acs aci acx acm iow acs_iow aci_iow acx_iow acm_iow fsz
```

Source	SS	df	MS	Number of obs	=	187
				F(10, 176)	=	19.46
Model	4.03692852	10	.403692852	Prob > F	=	0.0000
Residual	3.65191631	176	.020749524	R-squared	=	0.5250
				Adj R-squared	=	0.4981
Total	7.68884482	186	.041337875	Root MSE	=	.14405

frq	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
acs	.1262113	.0466721	2.70	0.008	.0341024	.2183203
aci	.6014172	.2004301	3.00	0.003	.2058616	.9969728
acx	.07166	.1293131	0.55	0.580	-.1835439	.3268638
acm	.0842323	.0106021	7.94	0.000	.0633087	.1051559
iow	.0164768	.0052135	3.16	0.002	.0061879	.0267658
acs_iow	.2478754	.1703651	1.45	0.147	-.088346	.5840969
aci_iow	.0200927	.0477209	0.42	0.674	-.0740861	.1142715
acx_iow	.0629461	.1266259	0.50	0.620	-.1869544	.3128466
acm_iow	.011711	.0088556	1.32	0.188	-.0057658	.0291878
fsz	.0159116	.0768776	0.21	0.836	-.1358091	.1676322
_cons	.23935	.313982	0.76	0.447	-.3803043	.8590044

```
. hettest
```

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of frq

chi2(1) = 2.32
Prob > chi2 = 0.1274

```
. vif
```

Variable	VIF	1/VIF
iow	1.83	0.545297
acm	1.73	0.578488
aci	1.52	0.659173
aci_iow	1.36	0.734787
acs	1.30	0.768182
acm_iow	1.21	0.829173
fsz	1.11	0.896889
acx	1.10	0.910939
acs_iow	1.10	0.912354
acx_iow	1.05	0.950013
Mean VIF	1.33	

```
. ovtest
```

Ramsey RESET test using powers of the fitted values of frq

Ho: model has no omitted variables

F(3, 173) = 0.40
Prob > F = 0.7531

```
. linktest
```

Source	SS	df	MS	Number of obs	=	187
Model	4.03871899	2	2.0193595	F(2, 184)	=	101.79
Residual	3.65012583	184	.01983764	Prob > F	=	0.0000
				R-squared	=	0.5253
				Adj R-squared	=	0.5201
Total	7.68884482	186	.041337875	Root MSE	=	.14085

frq	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_hat	1.255628	.8537278	1.47	0.143	-.4287267	2.939982
_hatsq	-.1151926	.3834134	-0.30	0.764	-.8716444	.6412592
_cons	-.1391645	.4693671	-0.30	0.767	-1.065198	.7868689

```
. xtreg frq acs aci acx acm iow acs_iow aci_iow acx_iow acm_iow fsz, fe
```

Fixed-effects (within) regression Number of obs = 187
Group variable: id Number of groups = 17

R-sq: Obs per group:
within = 0.6466 min = 11
between = 0.2494 avg = 11.0
overall = 0.4603 max = 11

corr(u_i, Xb) = -0.5327 F(10,160) = 29.27
Prob > F = 0.0000

frq	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
acs	.1141007	.0757802	1.51	0.134	-.0355577	.2637591
aci	1.378621	.2237865	6.16	0.000	.9366643	1.820577
acx	.2175495	.1116382	1.95	0.053	-.0029249	.4380239
acm	.07282	.0138111	5.27	0.000	.0455444	.1000955
iow	.0481871	.0068231	7.06	0.000	.0347121	.0616621
acs_iow	.4254039	.1984696	2.14	0.034	.0334459	.8173619
aci_iow	-.0781805	.0890823	-0.88	0.381	-.2541091	.0977482
acx_iow	-.0848068	.1154913	-0.73	0.464	-.3128907	.1432771
acm_iow	.0186038	.0092542	2.01	0.046	.0003276	.03688
fsz	-.0480979	.0850609	-0.57	0.573	-.2160849	.1198891
_cons	-.1052553	.3481263	-0.30	0.763	-.7927705	.5822599
sigma_u	.12326572					
sigma_e	.11817093					
rho	.52109258	(fraction of variance due to u_i)				

F test that all u_i=0: F(16, 160) = 6.34 Prob > F = 0.0000

```
. est store fixed
```

```
. xtreg frq acs aci acx acm iow acs_iow aci_iow acx_iow acm_iow fsz, re
```

Random-effects GLS regression Number of obs = 187
Group variable: id Number of groups = 17

R-sq: Obs per group:
within = 0.6252 min = 11
between = 0.4326 avg = 11.0
overall = 0.5163 max = 11

Wald chi2(10) = 221.03
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0000

frq	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
acs	.1145743	.0527927	2.17	0.030	.0111026	.218046
aci	.8632329	.2097439	4.12	0.000	.4521424	1.274323
acx	.1278745	.1215435	1.05	0.293	-.1103464	.3660954
acm	.0828231	.0115854	7.15	0.000	.0601161	.1055301
iow	.0267546	.0057878	4.62	0.000	.0154106	.0380986
acs_iow	.3117939	.1770328	1.76	0.078	-.035184	.6587718
aci_iow	.0045876	.0556921	0.08	0.934	-.1045668	.113742
acx_iow	.0021781	.1224367	0.02	0.986	-.2377933	.2421496
acm_iow	.0154984	.0088181	1.76	0.079	-.0017849	.0327816
fsz	-.0002546	.0788663	-0.00	0.997	-.1548296	.1543205
_cons	.0909528	.3215859	0.28	0.777	-.539344	.7212495
sigma_u	.03789144					
sigma_e	.11817093					
rho	.09323046	(fraction of variance due to u_i)				

```
. est store random
```

. hausman fixed random

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random		
acs	.1141007	.1145743	-.0004736	.0543652
aci	1.378621	.8632329	.5153877	.0780249
acx	.2175495	.1278745	.089675	.
acm	.07282	.0828231	-.0100031	.0075183
iow	.0481871	.0267546	.0214325	.0036133
acs_iow	.4254039	.3117939	.11361	.0897195
aci_iow	-.0781805	.0045876	-.082768	.0695273
acx_iow	-.0848068	.0021781	-.0869849	.
acm_iow	.0186038	.0154984	.0031054	.0028074
fsz	-.0480979	-.0002546	-.0478433	.0318665

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(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
 = 57.18
 Prob>chi2 = 0.0000
 (V_b-V_B is not positive definite)