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Board Attributes and Credit Risk Exposure of Listed Financial Service Firms in Nigeria

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Abstract

One of the statutory responsibilities of the corporate board of directors of financial services firms is to ensure the adequate financial health of the firms. The board composition and attributes must be of the same sophistication as the riskiness of the operations of institutions. This study examined the effects of the board of directors' characteristics on the credit risk exposure of listed financial service firms in Nigeria. The study used secondary data for a period of 10 years (2010-2019) in a sample of 29 financial service firms. Multiple panel regression technique of data analysis was applied, and the study found after controlling for firm size, firm leverage and firm age that Based on the analysis of data collected, the study concludes after controlling for firm age, firm size and firm leverage that there is a significant statistical negative correlation between credit risk exposure of listed financial service firms in Nigeria and the board of directors' characteristics. In specific terms, the study found that board size, board independence and board risk committee have a significant negative effect on the credit risk exposure of listed financial service firms in Nigeria during the period covered by the study. The study on the other hand found that board meetings have an insignificant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria during the period covered by the study. While board gender diversity has an insignificant positive effect on the credit risk exposure of listed financial service firms in Nigeria during the period covered by the study. The study, therefore, recommends that regulators should review the composition, size, and expertise of corporate board members, especially risk committees' members in the Nigerian financial institutions. The study also recommends that corporate boards should ensure that the board gender comprises women with accounting and finance backgrounds.

Keywords: *Corporate Governance, Agency Theory, Non-Performing Loans, Insurance*

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Background to the Study

Risks in the financial service industry have been the main determinants of financial system stability and the survival of financial institutions. For instance, credit risks which are usually positively related to volatility in the financial service firms have led to the failure of many banks and insurance companies. A study by Ghenimi, Chaibi, Ali, and Omri (2017), of a sample of banks in the Middle East and North Africa region confirm that credit risk and liquidity risk have an impact on the financial system stability. As such regulators and researchers have been experimenting with different factors to improve risk governance and the exposure of financial service firms to credit risk. Basel Committee on Banking Supervision (2016), argued that good corporate governance for banking firms increases the effectiveness of risk management, thereby increasing the financial strength of the financial institutions. In general, banks and insurance companies deliberately take the financial risk to generate revenue and provide services to their customers, which creates asymmetric information. Therefore, good risk governance of financial institutions is essential for boards of directors to focus more on risk assessment, management and mitigation. Thus, this study focuses on the impact board characteristics on the credit risk exposure of financial service firms in Nigeria.

It seems that the existing risk governance in the financial service firms is insufficient, which resulted in excessive credit risk-taking in financial institutions. Prior literature has focused primarily on the role of corporate governance in financial institutions, especially banks neglecting other crucial financial firms like insurance companies. This study fills the gap in the literature by relying on a relatively simple measure of a financial institutions' credit risk exposure, to study the relationship between some corporate governance variables and the degree of credit risk exposure. The study also fills the literature gap by introducing risk management committee variable that was neglected by the prior researches in Nigeria. Prior studies (Abdullah, Shukor, and Rahmat, 2017; Abdullah and Said, 2019) indicate that the risk management committee has effectively been playing role in the control, detection and prevention of risk especially in terms of financial risk. According to Abdullah et al., (2017), the existence of a stand-alone risk management committee is positively related to risk management disclosure and the non-existence of any financial crime incidence (Abdullah and aid, 2019).

The study is motivated by the crucial role played by financial service firms in the Nigerian economy, and it is important to maintain their stability. Moreover, financial service companies in Nigeria is under pressure to create liquidity in the competitive raging and aggressive business environment, which makes understanding of risk exposure banks and insurance firms very essential. On the one hand, to our knowledge, very few studies have examined the impact of board characteristics on the main risk of financial institutions in Nigeria. On the other hand, the Nigerian financial sector is exposed to economic and political changes, risk management measures become a necessity to strengthen the role of financial service firms in the economy. The study is therefore an attempt to provide an answer to the research question, what is the impact of board of directors' attributes on the credit risk exposure of financial service firms in Nigeria?

Research Objectives

The main objective of this study is to examine the effect of the board of directors' characteristics on the credit risk exposure of listed financial service firms in Nigeria. The specific objectives of the study are:

i. To determine the effect of the board of directors' size on the credit risk exposure of listed financial service firms in Nigeria.
ii. To evaluate the effect of the board of directors' independence on the credit risk exposure of listed financial service firms in Nigeria.
iii. To examine the effect of the board of directors' meetings on the credit risk exposure of listed financial service firms in Nigeria.
iv. To assess the effect of the board of directors' gender diversity on the credit risk exposure of listed financial service firms in Nigeria.
v. To determine the effect of the board of risk committee on the credit risk exposure of listed financial service firms in Nigeria.

Research Hypotheses

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

H_{01}: Board of directors' size has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.
H_{01}: Board of directors' independence has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.
H_{01}: Board of directors' meetings has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.
H_{01}: Board of directors' gender diversity has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.
H_{02}: The risk committee has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.

The current search for the solution to governance crises to save the Nigerian financial institutions necessitated this study. The study provides financial service firms with tools to be more effective in managing bank stability through the monitoring of credit risks exposure. The management would find this study useful as it assists them to identify how various aspects of corporate governance mechanisms affect the credit risk exposure of financial service firms and other factors affecting credit risk management in Nigeria. The findings from this study would also provide policymakers with information on the dynamics of the Nigerian financial service sector and in designing suitable practices to regulate the credit risk management among banks and other financial institutions. The study covers a period of ten years (2010-2019) and the financial service firms in the context of this study refers to the Deposit Money Banks and Insurance Companies listed on the floor of the Nigerian Stock Exchange (NSE) markets.

Literature Review and Theoretical Framework

Credit risk according to Ahmadi, Ahmadi and Abolhassani (2016), is connected with the operational activities of the banks and is among the most critical risks existing in the banking

and financial system, and most of the time, the harm related to the credit risk is more than the other risks. Glantz (2003), defined credit risk as the probability of non-repayment or delayed payment of the debt by the customer. Corporate governance on the other hand is seen by Vazifehdoust, Ahmadvand, and Sadehvand (2016), as a set of rules, regulations, institutions, and methods that determine how and in favour of whom the companies are managed.

Therefore, different theories explained the nexus between credit risk and corporate governance mechanisms. For instance, agency theory holds that the agent of the principal (managers) always acts in the interest of the absentee owners, but trying to be self-centred thereby creating agency problems that require effective monitoring. The corporate board was expected to monitor the managers to act in the best interest of all stakeholders. The three Lines of Defense Theory on the other hand, further argued that a company's top management has to set an effective system of internal controls to ensure accountability for risk assessment, which is seen as the first line of defence (Kersnar, 2009). Boards of directors and senior management are the main players served by the lines of defence and are well placed in ensuring that this model is reflected in the organization's risk management and control processes. It is mandatory for the three lines to existing in some form in all agencies, despite their size or complexity. Where the three separate lines exist and can be identified in an organization then risk management is considered to be strong (Hakim and Neamie, 2011).

Similarly, the Credit Risk Theory introduced by Merton (1974), is referred to as the structural theory. The theory explained a default incident obtained from the evolution of a firm's asset demonstrated by a process of distribution with persistent parameters. Merton (1974), noted that the class of models is referred to as structural models' courtesy of variables connected to a particular issuer. This type's evolution is typified by an asset of models where the conditional loss on defaulting is specific. In this case, the default can happen endlessly during a corporate bond lifetime not only upon maturity (Longstaff and Schwartz, 1995). There is a risk of nonpayment when a bank grants credit to its customers. Therefore, the systems, procedures, and controls established by a bank to ensure an efficient collection of loan repayments hence reducing the risk of non-payment are called credit risk management (Naceur and Goaied, 2003).

Review of Empirical Studies

The review shows that there are few or non-empirical studies that focused on the Nigerian financial services industry, which provided a research gap to fill. For example, Seyram, Yakubu and Bawuah (2014), examined the corporate governance and risk management in the banking sector of Ghana using a survey questionnaire administered to selected banks' board of directors, senior risk management officers as well as selected staff. The results of the study indicated that the board of directors, senior staff is actively involved in risk management. However, it was also noted that not all employees are engaged in risk management. The most important types of risk facing the sampled banks were operating risk, interest rate risk, credit risk, solvency risk, and liquidity risk. Through the study, it was also found out that the sampled banks were more or less efficient in managing risk.

Wangui (2014), investigated the effect of corporate governance on enterprise risk in commercial banks in Kenya by employing a cross-sectional study to fill the research gap. The primary data was then collected using a questionnaire sent to internal audit managers for their response to answer the research question. The findings proved that the board size, CRO presence in the executive council, as well as board independence, affected the CAMEL rating in active modus, while board diversity itself hurt the same score. The study recommends increasing independent directors and expanding the board size since these facets of corporate governance were believed to improve the banks' enterprise risk management.

Truong, Trinh, Duyen and Nguyen (2015), examined the impact of corporate governance on financial risk in Vietnamese Commercial Banks. They approached the corporate governance mechanism intending to study the impact of corporate governance dynamics on capital risk, credit risk, as well as liquidity risk in Vietnamese commercial banks. The approach divides corporate governance separately into the internal mechanism and external mechanism. The empirical study investigated 26 joint-stock commercial banks in the 2009-2013 period. The empirical study indicated that board strengths, information disclosure, foreign capital, and stakeholder roles have a significant impact on financial risk management in the banking systems.

In another study by Binh and Hoa (2015), explored the relationship between the default probability of banks due to their credit risks and the corporate governance structures of these banks from the perspective of creditors. The cumulative default probabilities and distance to default are estimated for a sample of 15 Vietnamese commercial banks to measure their risk-taking behaviour. After controlling for firm-specific characteristics, commercial banks with a smaller Board size of a bank, number of female shareholders in Board of directors, shareholder equity, and long-term loan are associated with significantly lower credit risk levels. A larger number of Supervisory Board and short-term debt has a relationship with lower credit risk levels.

Cornelius (2016), examined how credit risk management in commercial banks in Kenya is impacted by corporate governance. This study made use of a cross-sectional survey design as it takes place at one point in time. The study obtained secondary data through abstraction from financial statements as well as corporate governance-related statements for the commercial banks covered as they had been published in their annual reports. Findings indicate that large corporate practices, policies and rights of shareholders enhance credit risk management and such factors, when exploited, firm value is enhanced. The findings may be regarded as an indicator that an appropriate structure of governance is significant among financial institutions as the same affects the management of credit risk by the institution. The study findings are not only geared towards fine-tuning Commercial banks' governance concerning policy direction but also to ensure commercial bank collapse related to governance is anticipated with a view not to damage the critical risk management process.

Rose (2016), examined whether the presence of weak corporate governance features leads to more credit risk acceptance. Her study investigated the Danish banks in the year before the 2007 financial crisis and showed that increasing the remuneration of the board would increase

the bank's credit risk. On the other hand, increasing the number of board members will reduce credit risk and make a stronger control system and a better balance. Calomiris and Carlson (2016), studied the relationship between corporate governance and risk management in unprotected banks. They showed that the formal governance structure that has been selected internally creates a higher risk and has a higher effect on capital for risk management, but applies less managerial rights. Chen and Lin (2016), investigated the role of corporate governance on the relationship between credit risks, interest rates, and liquidity. They concluded that credit risks, interest rates, and liquidity are linked together and can reduce the interaction between them using corporate governance and laws. They also stated that ownership affects the risk appetite of the bank. They also showed that credit risks, liquidity, and interest rates have an internal connection, and as a result, banks should pay attention to the simultaneity of these risks in risk management activities relating to their corporate governance.

Francesco Vallascas, Sabur, Mollah and Kelvin Keasey (2017) examined the impact of the board's independence on the risk-taking of large banks following the global crisis of 2007-2009 for a sample of 262 large banks. Using Z-Score and ROA as two measures of risk, their main results showed that greater independence of the board of directors led to more conservative risk-taking in banking. This is because the independent board favours the increase of banking capitalization and the risk reduction of banking portfolios after the global crisis. A similar study Abobakr and Elgiziry (2017), using a sample of 27 Egyptian banks covering the period 2006-2011, studied the influence of board characteristics on risk-taking by banks. Empirical results indicate that the size of the board has a significant positive effect on risk-taking by banks.

Rose (2017), analyzed board structures in listed Danish banks in the years before the financial crisis by exploring the relationship between corporate governance characteristics and credit risk exposure. The article presents a novel approach as it relies on a newly developed risk metric entitled the "Supervision Diamond" introduced by the Danish FSA, which "external" board directors must address. It contains five thresholds for measuring a bank's exposure to credit risks i.e., the proportion of large customers, lending growth, the ratio of lending/deposits, liquidity buffer and the proportion of real estate loans. By employing quantitative governance variables, the article finds that increased executive director remuneration is associated with increased credit risk posed by the bank's borrowers. On the other hand, increasing the number of executive/ "inside" directors are associated with a lower credit risk exposure. It is argued that more "inside" directors on the executive board constitutes a stronger "checks and balance" system. The study also documents that the probability of obtaining state capital from the Danish credit bailout package is negatively related to larger boards as well as higher executive director remuneration. The policy implication is that financial authorities should be increasingly aware of insufficient corporate governance characteristics to prevent excessive credit risk exposure. Moreover, the article provides important insights on which corporate governance variables have a significant impact on a bank's credit risk exposure. This knowledge is valuable for financial authorities/policymakers considering future regulatory initiatives and how they should administer bank monitoring.

Switzer, Tu, and Wang (2017), examined the relationship between default risk and corporate governance in financial firms for 28 countries outside North America during the crisis and after the financial crisis. They showed that reduced risk of default helps to return the stock market in the post-crisis period. Moreover, they reported that both internal governance variables (i.e., institutional ownership, board composition, and the dichotomy of managing director) and the external regulatory factors have significant impacts on the default risk. Ali, Liu, and Su (2018) studied whether the quality of corporate governance affects the risk of default, emphasizing the role of growth opportunities and stock liquidity. They found that companies with more effective corporate governance have a significant relationship with more growth opportunities.

Sameera and Wijesena (2018), investigated the impact of board structure on the credit risk of banks listed in the Colombo Stock Exchange in Sri Lanka. Thirteen companies were selected from the listed companies in Colombo Stock Exchange from 2013 to 2017. The Board Size, Board Independence and Meeting Frequency were considered as independent variables, whereas, credit risk was a dependent variable. The credit risk was proxy by the Non-Performing Loan ratio. The control variables were Financial Leverage and Firm Size. A regression model was used to establish the relationship between board structure and credit risk. The overall results and findings statistically confirmed that the board size and board independence have significantly and negatively impacted the credit risk. Board meeting frequency, firm size and financial leverage have no significant impact on credit risk. Hence, the evidence suggests that the bank increases its board size and majority representation of independent non-executive directors in the board are important factors as they help reduce the credit risk exposure by the banks. The participation of independent non-executive members in large proportion improves the independence of the board and increases the capacity of corporate boards to effectively advise, monitor and consequently, reduce the credit risk.

Akbarian, Ali, Nader and Rasool (2019), examined the impacts of corporate governance on credit risk in the Iranian banking industry. The sample consists of 20 banks listed on the Tehran Stock Exchange during 2011-2016, using panel data. The results indicate that after adjusting the control variables namely the size, the financial leverage, the ratio of capital adequacy, the GDP and inflation, there is a significant negative relationship between corporate governance quality and the credit risk, which means more effective corporate governance will reduce information asymmetry, increases the clarity and stakeholder confidence, and finally reduces banks' credit risk. In a similar effort, Djebali and Zaghdoudi (2019), studied the effect of banking governance on credit risk and test the relationship between bank governance mechanisms and liquidity risk. To achieve this goal, they used a sample of 10 Tunisian banks observed during the period 1998-2015. The econometric approach used in this study is based on both the fixed and random effects models of panel data analysis. Our results show that credit risk and liquidity risk are directly related to bank governance mechanisms. These findings enable bank managers to better understand the factors influencing bank risk and serve as a basis for regulations to strengthen bank governance.

Methodology

This study employed a correlation research design in assessing the impact of board characteristics on the credit risk exposure of listed financial service firms in Nigeria. The population of this study comprises all the 43 Deposit Money Banks and Insurance Companies listed on the floor of the Nigerian Stock Exchange (NSE) Market as of 31st December 2019. However, all the banks and insurance firms that were not in the NSE listing for all the period (2010 to 2019) covered by the study were filtered out, because of the difficulties in accessing their data. Based on this, the population and sample size of the study is reduced to 29 firms (see appendix). The study used secondary data from the financial statements of the sampled firms for ten years.

Method of Data Analysis and Model Specification

The study employed the panel regression technique of data analysis, after addressing the effect of the problems of heteroskedasticity in the data, Ordinary Least Squares is adopted. This is necessary because the use of OLS in the presence of heteroskedasticity provides a spurious regression problem that can lead to statistical bias (Granger and Newbold 1974). Similarly, Gujarati (2004) opined that whatever conclusion we draw or inferences we make may be very misleading. Therefore, estimation using robust OLS is capable of producing estimators that are Blue (Best Linear Unbiased Estimators). The analysis is conducted using Statistics/Data Analysis Software (STATA 11.02). Therefore, the measurements of the variables used in the study are presented in Table 1;

Table 1: Variables Measurements

Variables	Measurement	Source/Empirical Support
Dependent variable		
Credit Risk for Banks	Non - performing loans/ Total gross loan	Pagano & Sedunov, (2016).
Credit risk for Insurance	(Premium Debtors +Due from Insurer + other Receivables)/Net Asset	Sisay (2017)
Independent Variables		
Board Size	The total number of the board of directors	Batool & Javid, (2014),
Board Diligence/Meetings	The total number of meetings	Demeh & Mohammed (2013), Kurawa & Ishaku (2014)
Board Independence	The proportion of non-executive directors to the total directors on the board	Maniagi et al (2013)
Risk Committee	Risk Committee Index	Al-Shaer & Zaman, (2016).
Control Variables		
Firms Age	Company Age	(Tang, Tian & Yan, 2015).
Firms Size	Natural log of total assets.	Wu, (2013), Toby (2014)
Leverage		Altman, 1968; Hillegeist et al., 2004).

The risk committee index was calculated by dividing the score obtained by the total score, from the attributes in table 2.

Risk Committee Index
Table 2.

S/N	Risk Committee Attributes	Measurement
1	Risk Committee Existence	1 if a firm has a stand-alone risk committee and 0 if otherwise
2	Risk Committee Size	Total number of directors in the committee
3	Risk Committee Composition	Number of non-executive directors in the committee
4	Risk Committee Independence	Number of independent directors in the committee
5	Risk Committee Meeting frequency	Number of meetings held during the accounting period
6	Risk Committee Expertise	Number of directors with accounting and/or financial background in the committee
7	Risk Committee Gender Diversity	Number of female directors in the committee

Source: Generated by the Researcher based on Al-Shaer and Zaman (2016)

Models Specification

To measure the impact of board of directors' attributes on credit risk exposure, as well as the moderating effect of the risk committee of listed financial service firms in Nigeria, the following econometric models are used;

$$CRE_{it} = \beta_{0it} + \beta_1 BSZ_{it} + \beta_2 BIN_{it} + \beta_3 BMT_{it} + \beta_4 BGD_{it} + \beta_5 RC_{it} + \beta_6 FSZ_{it} + \beta_7 LEV_{it} + \beta_8 AGE_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots i$$

Where CRE_{it} is credit risk exposure of firm I in year t; BSZ_{it} is board size of the firm I in year t; BIN_{it} is board independence of firm I in year t; BMT_{it} is board meetings of firm I in year t; BGD_{it} is board gender diversity of firm I in year t; RC_{it} is risk committee of the firm I in year t; FSZ_{it} is the size of the firm I in year t; LEV_{it} is the leverage of firm I in year t; AGE_{it} is the age of firm I in year t. And $\beta_{0it}$is the intercept**,** whileβ_1**-** β_{12}**,** are the coefficients/estimators andε_{it} is the residuals.

Results and Discussion

Descriptive Statistics

The descriptive statistics are presented in table 3 showing the minimum, maximum, mean, standard deviation, skewness, and kurtosis regarding the variables used in the study. The analysis covered both the moderated and unmoderated models of the study.

Table 3: Descriptive Statistics

Variables	Mean	Std. Dev	Min.	Max.	Skewness	Kurtosis	N
CRE	0.1029	0.1777	0.0001	0.9873	2.8026	11.264	290
BSZ	12.079	3.8036	6.0000	23.000	0.4210	2.3737	290
BIN	0.2075	0.0844	0.0800	0.5700	1.2838	4.6072	290
BMT	3.9689	0.6777	2.0000	7.0000	1.5076	11.936	290
BGD	2.4552	1.1763	1.0000	6.0000	1.3469	5.1981	290
RC	0.9998	0.2089	0.3790	1.5161	-0.4165	3.2446	290
FSZ	6.9920	1.1927	5.0528	10.086	0.5928	2.6318	290
LVR	0.5853	0.2891	0.0060	0.9984	-0.3595	1.7311	290
AGE	36.362	12.013	15.000	61.000	0.3089	1.8283	290

Source: Descriptive Statistic Results Using STATA 13 (Appendix)

Table 3 shows that the average credit risk exposure (CRE) of the listed financial service firms is 0.1029, with the minimum and maximum values of 0.0001 and 0.9873 respectively. The mean value implies that the financial firms' average credit risk exposure during the period covered by the study is 10.29%. The standard deviation of 0.1777 indicated that the data is widely dispersed from both sides of the mean value by 0.1777. The values of skewness and kurtosis of 2.8026 and 11.2639 respectively, provide preliminary evidence that the data did not follow the normal curve. The results from table 3 shows that the average board size (BSZ) of the listed financial service firms is 12.079, with the minimum and a maximum number of directors of 6 and 23 respectively. The mean value implies that the financial firms' average number of directors during the period covered by the study is 12. The standard deviation of 3.8036 indicated that the data is dispersed from both sides of the mean value by 3.8036. The values of skewness and kurtosis of 0.4210 and 2.3737 respectively, shows that the data did not follow the normal curve.

The descriptive results in table 3 show that the average board of directors' independence (BIN) of the listed financial service firms is 0.2075, with the minimum and maximum values of 0.08 and 0.57 respectively. The mean value implies that the listed financial firms' average independent directors during the period covered by the study are 20.75%. The standard deviation indicated that the data is dispersed from both sides of the mean value by 0.0844. The values of skewness and kurtosis of 1.2838 and 4.6072 respectively, provide preliminary evidence that the data did not follow the normal curve. The table also shows that the average board size meetings (BMT) of the listed financial service firms is 3.9689, with the minimum and a maximum number of meetings of 2 and 7 respectively. The mean value suggested that the listed financial service firms' average number of meetings during the period covered by the study is 4. The standard deviation shows that the data is dispersed from both sides of the mean value by 0.6777. The values of skewness and kurtosis of 1.5076 and 11.937 respectively, shows that the data did not follow the normal curve and hence did not meet the normality assumption.

The descriptive results from the table show that the average board of directors' gender diversity (BGD) of the listed financial service firms is 2.4552, with minimum and maximum values of 1 and 6 respectively. The mean value indicates that the listed financial service firms' average number of female directors during the period covered by the study is 2. The standard deviation indicated that the data is dispersed from both sides of the mean value by 1.1763. The values of skewness and kurtosis of 1.3469 and 5.1981 respectively, provide evidence that the data did not follow the normal curve. Table 3 also shows that the average risk committee score (RC) of the listed financial service firms is 0.9998, with the minimum and maximum scores of 0.3790 and 1.5161 respectively. The mean value implies that the listed financial service firms' average risk committee score during the period covered by the study is 99.98%. The standard deviation shows that the data is dispersed from both sides of the mean value by 0.2089. The values of skewness and kurtosis of -0.4165 and 3.2446 respectively, shows that the data did not follow the normal curve as well as the normality assumption.

Moreover, the average risk committee score of 99.98% implies that there was a presence of risk committee in the listed financial service firms during the period, together with the other risk committee characteristics (risk committee size, risk committee composition, risk committee independence, risk committee meetings frequency, risk committee expertise and risk committee gender diversity). Table 3 indicates that the average firm size (FSZ) which is the natural logarithm of the scaled total assets of the listed financial service firms is 6.9220, with the minimum and maximum values of 5.0528 and 10.0858 respectively. The mean value implies that the listed financial service firms' average size of firms during the period covered by the study is 7. The standard deviation shows that the data is dispersed from both sides of the mean value by 1.1927. The values of skewness and kurtosis of 0.5928 and 2.6318 respectively, shows that the data did not follow the normal curve as well as the normality assumption.

The descriptive results from the table also show that the average leverage (LVR) of the listed financial service firms is 0.5853, with the minimum and maximum values of 0.006 and 0.9984 respectively. The mean value indicates that the listed financial service firms' average debt to total assets ratio during the period covered by the study is 58.53%. The standard deviation indicated that the data is dispersed from both sides of the mean value by 0.2891. The values of skewness and kurtosis of -0.3595 and 1.7311 respectively, provide evidence that the data did not follow the normal distribution. The table also shows that the average age (AGE) of the listed financial service firms is 36.362 years, with the minimum and maximum years of 15 and 61 respectively. The mean value implies that the listed financial service firms' average age from incorporation date during the period covered by the study is 36 years. The standard deviation shows that the data is widely dispersed from both sides of the mean value by 12.0131. The values of skewness and kurtosis of 0.3089 and 1.8283 respectively, shows that the data did not follow the normal curve and the normality assumption.

Although the analysis of the descriptive statistics suggested that the data collected for the variables of the study did not meet the normality assumption, as indicated by the standard deviations and the coefficients of skewness and kurtosis. A more specific test for normal data (Shapiro Wilk) test and the Jacque Bera test is applied to determine the normality of the data in the following sub-section, from the result in table 4.

Table 4: Normality Test

Variables	W	V	Z	Prob>Z	N
CRE	0.6015	82.399	10.399	0.0000	290
BSZ	0.9644	7.365	4.679	0.0000	290
BIN	0.8926	22.210	7.266	0.0000	290
BMT	0.9209	16.351	6.548	0.0000	290
BGD	0.9155	17.478	6.705	0.0000	290
RC	0.9852	3.069	2.628	0.0043	290
FSZ	0.9553	9.241	5.211	0.0000	290
LVR	0.9026	20.128	7.035	0.0000	290
AGE	0.9426	11.865	5.797	0.0000	290

Source: Results Using STATA 13 (Appendix)

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 4 indicates that data from all the variables of the model are not normally distributed because the P-values are significant at 1% level of significance (p-values of 0.0000). Therefore, the null hypothesis (that the data is normally distributed) is rejected for CRE, BSZ, BIN, BMT, BGD, RC, FSZ, LVR, and AGE. This may lead to some biased results in OLS regression and, hence the need for a more generalized regression model.

Correlation Analysis

Table 5 shows the Pearson Correlation coefficients between the dependent and the independent variables. It also shows the relationship amongst the independent variables. The asterisk beside the correlation coefficient shows the level of significance of the coefficients.

Table 5: Correlation Matrix

	CRE	BSZ	BIN	BMT	BGD	RC	FSZ	LVR	AGE
CRE	1.0000								
BSZ	-0.2739*	1.0000							
BIN	-0.1738*	-0.3681*	1.0000						
BMT	-0.0688	-0.0380	-0.1005	1.0000					
BGD	-0.2444*	0.4621*	-0.1163**	0.1654*	1.0000				
RC	-0.3446*	0.4126*	0.1164**	0.1257**	0.4187*	1.0000			
FSZ	-0.1448**	0.4451*	-0.2173*	0.0847	0.1289**	0.1539*	1.0000		
LVR	-0.0375	-0.4216*	-0.0036	-0.0349	-0.0407*	0.1763*	0.2994*	1.0000	
AGE	-0.0156	-0.0915*	-0.0119	0.2149*	-0.0276*	0.1267*	-0.0125	-0.0590	1.0000

*Significant at 1% Level **Significant at 5% Level ***Significant at 10% Level

Source: Correlation Matrix Results Using STATA 13 (Appendix)

Table 5 shows that credit risk exposure (CRE) is negatively correlated with the board of directors' size (BSZ) of the listed financial service firms in Nigeria before moderation, from the correlation coefficient of -0.2739, which is significant at 1% level of significance. This implies

that credit risk exposure has an inverse relation with the size of the board of directors during the period under review.

The results from Table 5 shows that there is a significant negative association between credit risk exposure and board of directors' independence (BIN) of the listed financial service firms in Nigeria before moderation, from the correlation coefficient of -0.1738, which is statistically significant at 1% level of significance. This implies that credit risk exposure reduces as the composition of independent directors on the board increases. The results also show that there is a negative correlation between credit risk exposure and board of directors' meetings (BMT) of the listed financial service firms in Nigeria before moderation, from the correlation coefficient of -0.0688, which is not statistically significant at all levels of significance. This implies that credit risk exposure decreases as the board meeting frequency increases.

Table 5 indicates that there is a significant negative correlation between credit risk exposure and board gender diversity (BGD) of the listed financial service firms in Nigeria before moderation, from the correlation coefficient of -0.2444 which is statistically significant at 1% level of significance. This implies that credit risk exposure reduces as the composition of female directors on the board increases. The results also indicate that there is a negative correlation between credit risk exposure and risk committee (RC) of the listed financial service firms in Nigeria, from the correlation coefficient of -0.3446, which is statistically significant at 1% level of significance. This implies that credit risk exposure decreases with the presence and attributes of risk committees increases.

For the control variables, the Table shows that credit risk exposure (CRE) is negatively correlated with firm size (FSZ) of the listed financial service firms in Nigeria, from the correlation coefficient of -0.1448, which is statistically significant at 5% level of significance. This implies that credit risk exposure and size of the firm move in the opposite direction during the period under review. Similarly, there is an insignificant positive relationship between credit risk exposure (CRE) and firm leverage (LVR) of the listed financial service firms in Nigeria, from the correlation coefficient of 0.0375, which is not statistically significant at all levels of significance. This implies that credit risk exposure and firm leverage move in the same direction during the period under review. Additionally, credit risk exposure (CRE) is negatively correlated with firm age (AGE) of the listed financial service firms in Nigeria, from the correlation coefficient of -0.0156, which is not statistically significant at all levels of significance. This suggests that credit risk exposure and size of the firm move in the opposite direction during the period under review.

Robustness Tests

This section presents the results from the robustness tests conducted. The robustness tests include the Multicollinearity test, Heteroscedascticity test and normality test of the error term.

Table 6: Multicollinearity Test

Variables	VIF	TV(I/TV)
BSZ	2.60	**0.3849**
BGD	1.60	**0.6266**
RC	1.54	**0.6493**
LVR	1.42	**0.7036**
BIN	1.40	**0.7152**
FSZ	1.30	**0.7664**
BMT	1.15	**0.8667**
AGE	1.10	**0.9128**
MEAN VIF	1.51	

Source: Results Using STATA 13 (Appendix)

Table 6 indicated the absence of the perfect multicollinearity among the explanatory variables for both the moderated and unmoderated variables, as shown by the mean VIF of 1.51. The decision criterion for the VIF is that a value of 10 and above implies the presence of perfect multicollinearity. Similarly, all the Tolerance Values for the model are more than 0.1 testifying to the absence of multicollinearity in the models.

The heteroscedasticity Test is checked using the Breuch Pagan/Cook-Weisberg test for heteroscedasticity and Cameron and Trivedi's Test for heteroscedasticity using the results from Table 7.

Table 7: Heteroskedasticity Test

Statistics	
Breusch-Pagan Test	
Chi-Square	134.99
Prob>Chi Square	0.0000
Cameron &Trivedi's IM Test	
Chi-Square	108.04
P-Value	0.0000

Source: Results Using STATA 13 (Appendix)

Table 7 shows the presence of Heteroskedasticity in the model as indicated by the Breuch Pagan/Cook-Weisberg test for heteroskedasticity Chi-square of 134.99 with a p-value of 0.0000. Moreover, Cameron and Trivedi's Test for heteroscedasticity also confirms the problem of heteroscedasticity in the model of the study, from the Chi-square of 108.04 with a p-value of 0.0000. This makes the interpretation of Ordinary Least Square (OLS) not suitable because of the violation of the classical assumptions of OLS. However, steps were taken to correct it by estimating a robust standard error and conducting a normality test of the error term.

Normality of the Error Term (Kernel Density), based on the kernel density test for normality of the error term, it was found that most of the residuals of the error term showed that they were tolerably mild. As such, a high level of normality of the error term was attained for both the moderated model and unmoderated model of the study. In the moderated model the kernel density estimate shows that it is normally distributed which is neither skewed to the right nor left. For the moderated model, it was shown that the error term is normally distributed except that it is slightly skewed to the right (See Appendix).

Regression Result and Hypotheses Testing

In this section, the interpretation, analysis and discussion of the regression results in respect of the model are presented. Hypotheses formulated earlier in chapter one was tested based on the analysis.

Table 8: Summary of Robust Random-Effects (GLS) Regression

Variables	Coef.	t-stat	P-value
BSZ	-0.0163	-4.36	0.000
BIN	-0.5838	-3.92	0.000
BMT	-0.0291	-0.86	0.388
BGD	0.0039	0.36	0.718
RC	-0.1621	-2.60	0.009
FSZ	-0.0051	-0.91	0.363
LVR	0.9026	3.52	0.000
AGE	0.0001	0.11	0.909
Constant	0.6294	3.69	0.000
R Square	0.2468		
F-Statistic	52.82		0.0000
Hman Test	10.22		0.2499
LM Test	15.96		0.0000

Source: Results Using STATA 13 (Appendix)

The results from Table 8 show that the Hausman specification test for choice between the Fixed-Effect Regression Model and Random-Effect Regression Model. The test confirms that the Random-Effect Regression Model is the most suitable for the study, from the Hausman Chi-square value of 10.22 with a p-value of 0.2499. However, the Breusch and Pagan Lagrangian Multiplier (LM) test for Random Effects, which indicated that there is statistically significant variance among the units in the panel (Chi-square of 15.96 with a p-value of 0.000) confirmed that the Random-Effect regression model is appropriate for interpretation.

The cumulative R-square of 0.2468 for unmoderated variables, which is the multiple coefficients of determination, indicated that the independent variables jointly explained 24.68% of the total variation in the dependent variable (credit risk exposure). Hence, it signified that 24.68% of the total variation in credit risk exposure of listed financial service firms in Nigeria is accounted for by the proportion of women directors on the board, percentage of independent directors in the board, the total number of board members, number

of board meetings, risk committee, and other control variables used in the study. The F-Statistic (Wald Chi-Square) value of 52.82, which is statistically significant at 1% level of significance (p-value 0.0000), indicates that the model is fit at a 99% confidence level. Based on the overall fitness of the model, the analysis of the regression estimators as well as the hypotheses testing would be conducted.

Table 8 shows that board size (BSZ) has a significant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of -0.0163 and t-value of -4.36. This is significant at a 1% level of significance (p-value 0.000). This implies that for every increase in the number of board members, there is a significant decrease in the level of credit risk exposure by listed financial service firms during the period under review. Based on this evidence, the study rejects the null hypothesis one (H01) which states that board size has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.

The results from table 8 also shows that board of directors' independence (BIN) has a significant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of -0.5838 and t-value of -3.92. This is statistically significant at a 1% level of significance (p-value 0.000). This implies that for every increase in the number of independent board members, there is a significant decrease in the level of credit risk exposure by listed financial service firms during the period under review. Based on this evidence, the study rejects the null hypothesis two (H02) which states that board independence has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.

The table also revealed that board meetings frequency (BMT) has an insignificant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of -0.0291 and t-value of -0.86. This is not significant at all levels of significance (p-value 0.388). This implies that for every increase in the number of board meetings, there is a decrease in the level of credit risk exposure by listed financial service firms during the period under review. But is not significant, based on this evidence, the study failed to reject the null hypothesis three (H03) which states that board meetings have no significant effect on the credit risk exposure of listed financial service firms in Nigeria.

Table 8 shows that board gender diversity (BGD) has an insignificant statistical positive effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of 0.0039 and t-value of 0.36. This is not significant at all levels of significance (p-value 0.718). This implies that for every increase in the number of women on the board, there is a significant increase in the level of credit risk exposure by listed financial service firms during the period under review. But the result is not statistically significant, based on this evidence, the study failed to reject the null hypothesis four (H04) which states that board gender diversity has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.

The table also indicates that risk committee (RC) has a significant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of -0.1621 and t-value of -2.60. This is significant at a 1% level of significance (p-

value 0.009). This implies that for every increase in the quality and composition of risk committee members, there is a significant decrease in the level of credit risk exposure by listed financial service firms during the period under review. Based on this evidence, the study rejects the null hypothesis five (H05) which states that the risk committee has no significant effect on the credit risk exposure of listed financial service firms in Nigeria.

Lastly, the table shows that firm size has an insignificant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of -0.0051 and t-value of -0.91. This is not significant at all levels of significance (p-value 0.363). This implies that for every increase in the size of the assets of a firm, there is a significant decrease in the level of credit risk exposure by listed financial service firms during the period under review. The results from the table also revealed that firm leverage has a significant statistical positive effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of 0.1180 and t-value of 3.52. This implies that for every increase in the firm debt components of capital structure, there is a significant increase in the level of credit risk exposure by listed financial service firms during the period under review. The result shows that firm age has an insignificant statistical positive effect on the credit risk exposure of listed financial service firms in Nigeria, from the regression coefficient of 0.0001 and t-value of 0.11. This is not significant at all levels of significance (p-value 0.909). This implies that for every increase in the age of a firm, there is a significant increase in the level of credit risk exposure by listed financial service firms during the period under review.

Conclusion and Recommendation

This study focused on the relationship between corporate board characteristics and the level of credit risk exposure of listed financial institutions in Nigeria. Based on the analysis of data collected, the study concludes after controlling for firm age, firm size and firm leverage that there is a significant statistical negative correlation between credit risk exposure of listed financial service firms in Nigeria and the board of directors' characteristics. In specific terms, the study concludes that board size, board independence and board risk committee have a significant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria during the period covered by the study. The study on the other hand concludes that board meetings have an insignificant statistical negative effect on the credit risk exposure of listed financial service firms in Nigeria during the period covered by the study. While board gender diversity has an insignificant statistical positive effect on the credit risk exposure of listed financial service firms in Nigeria during the period covered by the study.

This study recommends that regulators should review the composition, size, and expertise of corporate board members, especially risk committees' members in the Nigerian financial institutions. It also recommends that corporate boards should ensure that the board gender comprises women with accounting and finance backgrounds.

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APPENDICES

```
. xtset id year, yearly
       panel variable:  id (strongly balanced)
        time variable:  year, 2010 to 2019
                delta:  1 year
```

```
. xtsum cre bsz bin bmt bgd rc fsz lvr age
```

Variable		Mean	Std. Dev.	Min	Max	Observations	
cre	overall	.102981	.177719	.0001	.9873	N =	290
	between		.0985641	.00737	.37972	n =	29
	within		.1489016	-.272839	.710561	T =	10
bsz	overall	12.07931	3.803648	6	23	N =	290
	between		3.720347	7	20.4	n =	29
	within		1.028487	8.67931	14.67931	T =	10
bin	overall	.2074828	.0844412	.08	.57	N =	290
	between		.0747547	.088	.405	n =	29
	within		.0414257	.0744828	.5944828	T =	10
bmt	overall	3.968966	.6776733	2	7	N =	290
	between		.5203731	3.4	6.2	n =	29
	within		.4437182	2.268966	4.968966	T =	10
bgd	overall	2.455172	1.176349	1	6	N =	290
	between		1.035645	1	4.8	n =	29
	within		.5870576	.6551724	3.855172	T =	10
rc	overall	.9998475	.2089337	.3790272	1.516109	N =	290
	between		.1159656	.6127606	1.320278	n =	29
	within		.1749973	.5260636	1.460997	T =	10
fsz	overall	6.922037	1.192727	5.052841	10.08579	N =	290
	between		.6686831	5.950744	8.543282	n =	29
	within		.9946788	4.173535	9.645082	T =	10
lvr	overall	.5853463	.2890835	.006	.9984	N =	290
	between		.242257	.17572	.91288	n =	29
	within		.1634273	-.1349637	1.218396	T =	10
age	overall	36.36207	12.01311	15	61	N =	290
	between		11.84942	19.5	56.5	n =	29
	within		2.877246	31.86207	40.86207	T =	10

```
. swilk cre bsz bin bmt bgd rc fsz lvr age
```

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
cre	290	0.60145	82.399	10.339	0.00000
bsz	290	0.96438	7.365	4.679	0.00000
bin	290	0.89257	22.210	7.266	0.00000
bmt	290	0.92091	16.351	6.548	0.00000
bgd	290	0.91546	17.478	6.705	0.00000
rc	290	0.98516	3.069	2.628	0.00430
fsz	290	0.95530	9.241	5.211	0.00000
lvr	290	0.90264	20.128	7.035	0.00000
age	290	0.94261	11.865	5.797	0.00000

```
. pwcorr cre bsz bin bmt bgd rc fsz lvr age, star (0.05) sig
```

	cre	bsz	bin	bmt	bgd	rc	fsz
cre	1.0000						
bsz	-0.2739*	1.0000					
	0.0000						
bin	-0.1738*	-0.3681*	1.0000				
	0.0030	0.0000					
bmt	-0.0688	-0.0380	-0.1005	1.0000			
	0.2429	0.5195	0.0874				
bgd	-0.2444*	0.4621*	-0.1163*	0.1654*	1.0000		
	0.0000	0.0000	0.0479	0.0048			
rc	-0.3446*	0.4126*	0.1164*	0.1257*	0.4187*	1.0000	
	0.0000	0.0000	0.0477	0.0323	0.0000		
fsz	-0.1448*	0.4451*	-0.2173*	0.0847	0.1289*	0.1539*	1.0000
	0.0136	0.0000	0.0002	0.1502	0.0282	0.0087	
lvr	0.0375	0.4216*	-0.0036	-0.0349	-0.0407	0.1763*	0.2994*
	0.5243	0.0000	0.9516	0.5540	0.4901	0.0026	0.0000
age	-0.0156	-0.0915	-0.0119	0.2149*	-0.0276	0.1267*	-0.0125
	0.7914	0.1201	0.8398	0.0002	0.6395	0.0310	0.8321

	lvr	age
lvr	1.0000	
age	-0.0590	1.0000
	0.3168	

```
. reg cre bsz bin bmt bgd rc fsz lvr age
```

Source	SS	df	MS		
Model	2.30114889	8	.287643612	Number of obs	= 290
Residual	6.89147142	281	.024524809	F(8, 281)	= 11.73
				Prob > F	= 0.0000
Total	9.19262031	289	.031808375	R-squared	= 0.2503
				Adj R-squared	= 0.2290
				Root MSE	= .1566

cre	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
bsz	-.0191095	.0039035	-4.90	0.000	-.0267933	-.0114258
bin	-.6941664	.1289994	-5.38	0.000	-.9480942	-.4402387
bmt	-.0214067	.014602	-1.47	0.144	-.0501498	.0073365
bgd	.0013446	.0098925	0.14	0.892	-.0181281	.0208174
rc	-.1402274	.0547169	-2.56	0.011	-.2479345	-.0325204
fsz	-.0054799	.003976	-1.38	0.169	-.0133065	.0023467
lvr	.1228175	.0292245	4.20	0.000	.0652907	.1803442
age	-.0000555	.0007484	-0.07	0.941	-.0015286	.0014176
_cons	.644665	.0801231	8.05	0.000	.4869473	.8023827

```
. hettest

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

         chi2(1)      =   134.99
         Prob > chi2  =   0.0000
```

```
. imtest

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	108.04	44	0.0000
Skewness	35.99	8	0.0000
Kurtosis	7.77	1	0.0053
Total	151.80	53	0.0000

```
. vif
```

Variable	VIF	1/VIF
bsz	2.60	0.384952
bgd	1.60	0.626649
rc	1.54	0.649304
lvr	1.42	0.703637
bin	1.40	0.715194
fsz	1.30	0.766430
bmt	1.15	0.866651
age	1.10	0.912768
Mean VIF	1.51	

```
. xtreg cre bsz bin bmt bgd rc fsz lvr age, fe

Fixed-effects (within) regression               Number of obs      =       290
Group variable: id                              Number of groups   =        29

R-sq:  within  = 0.1680                         Obs per group: min =        10
       between = 0.0364                                        avg =      10.0
       overall = 0.0004                                        max =        10

                                                F(8,253)           =      6.39
corr(u_i, Xb)  = -0.9101                        Prob > F           =    0.0000
```

cre	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
bsz	.0164321	.0133717	1.23	0.220	-.009902	.0427661
bin	-.3008223	.2231235	-1.35	0.179	-.7402382	.1385937
bmt	-.0205844	.0231968	-0.89	0.376	-.0662679	.0250991
bgd	.0141548	.0186709	0.76	0.449	-.0226153	.0509249
rc	-.0605744	.1196949	-0.51	0.613	-.2962996	.1751508
fsz	-.0039762	.0048574	-0.82	0.414	-.0135423	.0055899
lvr	.1154781	.033136	3.48	0.001	.0502205	.1807357
age	-.0169404	.0092301	-1.84	0.068	-.035118	.0012373
_cons	.6216221	.1766706	3.52	0.001	.2736897	.9695544
sigma_u	.28409488					
sigma_e	.14487524					
rho	.79361755	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(28, 253) =     2.69                 Prob > F = 0.0000

. est store fixed
```

```
. xtreg cre bsz bin bmt bgd rc fsz lvr age, re

Random-effects GLS regression                   Number of obs      =       290
Group variable: id                              Number of groups   =        29

R-sq:  within  = 0.1446                         Obs per group: min =        10
       between = 0.4941                                        avg =      10.0
       overall = 0.2468                                        max =        10

                                                Wald chi2(8)       =     63.94
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

cre	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
bsz	-.0162961	.0051822	-3.14	0.002	-.026453	-.0061393
bin	-.5838441	.1632154	-3.58	0.000	-.9037404	-.2639478
bmt	-.0291448	.0172055	-1.69	0.090	-.062867	.0045773
bgd	.003853	.0124773	0.31	0.757	-.020602	.028308
rc	-.1620533	.0602721	-2.69	0.007	-.2801844	-.0439221
fsz	-.0050748	.0043108	-1.18	0.239	-.0135239	.0033742
lvr	.1180375	.0305094	3.87	0.000	.0582403	.1778348
age	.0001112	.0011934	0.09	0.926	-.0022278	.0024502
_cons	.6293915	.0962912	6.54	0.000	.4406642	.8181188
sigma_u	.06628519					
sigma_e	.14487524					
rho	.17310022	(fraction of variance due to u_i)				

```
. est store random

. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
bsz	.0164321	-.0162961	.0327282	.0123267
bin	-.3008223	-.5838441	.2830218	.1521342
bmt	-.0205844	-.0291448	.0085604	.0155584
bgd	.0141548	.003853	.0103018	.0138895
rc	-.0605744	-.1620533	.1014788	.1034124
fsz	-.0039762	-.0050748	.0010987	.0022385
lvr	.1154781	.1180375	-.0025594	.0129297
age	-.0169404	.0001112	-.0170516	.0091526

```
                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(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       10.22
            Prob>chi2 =      0.2499


. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        cre[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+-----------------------------
             cre |    .0318084        .178349
               e |    .0209888       .1448752
               u |    .0043937       .0662852

        Test:   Var(u) = 0
                           chibar2(01) =    15.96
                        Prob > chibar2 =   0.0000
```

```
. xtreg cre bsz bin bmt bgd rc fsz lvr age, re robust

Random-effects GLS regression                   Number of obs      =       290
Group variable: id                              Number of groups   =        29

R-sq:  within  = 0.1446                         Obs per group: min =        10
       between = 0.4941                                        avg =      10.0
       overall = 0.2468                                        max =        10

                                                Wald chi2(8)       =     52.82
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

                                               (Std. Err. adjusted for 29 clusters in id)
------------------------------------------------------------------------------
             |               Robust
         cre |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         bsz |  -.0162961   .0037354    -4.36   0.000    -.0236174   -.0089748
         bin |  -.5838441   .1490506    -3.92   0.000    -.8759778   -.2917103
         bmt |  -.0291448   .0337796    -0.86   0.388    -.0953516    .0370619
         bgd |    .003853   .0106823     0.36   0.718    -.0170839    .0247899
          rc |  -.1620533   .0622183    -2.60   0.009    -.2839989   -.0401076
         fsz |  -.0050748   .0055765    -0.91   0.363    -.0160046    .0058549
         lvr |   .1180375   .0335367     3.52   0.000     .0523069    .1837682
         age |   .0001112   .0009685     0.11   0.909    -.0017871    .0020095
       _cons |   .6293915   .1703551     3.69   0.000     .2955016    .9632814
-------------+----------------------------------------------------------------
     sigma_u |  .06628519
     sigma_e |  .14487524
         rho |  .17310022   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. predict residual
(option xb assumed; fitted values)

. kdensity residual
```