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AGE AND EDUCATIONAL DIVERSITY IN CORPORATE BOARDS: DOES IT AFFECT RISK-TAKING BEHAVIOUR?

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Abstract:

This study explores the various dimensions of board diversity and its impact on firm risks in an emerging market like India. The research concentrates on large and mid-cap companies listed in the BSE. To quantify diversity, researchers used percentage and Blau index, and for firm risk, volatility of return on assets and financial leverage are used separately. To estimate the regression result, panel regression is applied. The findings document that structural diversity is significant to overall firm risk and financial risk in few models, whereas age and educational diversity show statistically insignificant effect on both risk measures. This empirical research helps to understand the relationship between board diversity and risk-taking behavior and how board diversity is a case of deeper insight for corporate decisions. Furthermore, the insignificant results of diversity are not considered in this research but it is important for researchers to understand the theoretical reasoning behind the effect of each separate diversity aspect. The investigation takes into consideration not just one dimension of diversity but includes three dimensions viz. structural, age and educational diversity. There is dearth of studies that relates board diversity with risk.

Keywords: Board diversity, Structural Diversity, Age Diversity, Educational Diversity, Firm Risk.

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1. Introduction

During the last two decades, diversity in the Board has been a burning issue in the arena of corporate governance in developed and emerging economics. There are research contributions to investigate the outcome of diversity on firm performance and risk-taking behavior. The impression of corporate governance reveals that it is related to the group of people nominated by owners for taking effective decisions that impact financial performance and risk-taking (Terjesen et al., 2015). The Board of Directors play a decision-making role by reducing information asymmetry, managing risks and consequently promoting firm value (Gouiaa, 2018). However, since the decisions taken by the Board affect firm risk which impacts financial performance, it is required to know the connection between Board diversity and risk (Nguyen, 2011). In this regard, the term 'Board diversity' is relevant which means varieties in respect of gender, education, functional background, age, experience, knowledge, expertise, social networking, ethnicity, nationality and value systems. It is further classified on the basis of skills, duties, experiences, demographic, cognitive, observable and non-observable factors (Bernile et al., 2018 and Bhat et al., 2020). The possible diversity-risk connection adds new zeal to corporate governance functioning mechanism that requires further investigation. It is pertinent to mention that demographic and cognitive characteristics of directors may increase Board effectiveness by boosting creativity levels but these also have consequential impact on risk perception (Shalhoub, 2019). Bernile et al. (2018) finds that heterogeneity amongst the directors can minimize firm risk and enhance firm performance. Furthermore, study by Bernile et al. (2016) observes that greater Board diversity is related to low volatility. The heterogeneous Board fosters more use of own fund and brings in strong advisory and monitoring role that minimizes overall risk. However, the effect of diversity is not always favorable. As noted by Berger et al. (2014), greater diversity leads to long and complicated communication process among Board members. The presence of individuals from different socioeconomic culture might restrict their decision-making ability and create impediments in cooperation which affects firm risk (Berger et. al., 2014).

From the extant literature, it is crystal clear that heterogeneity among board members impacts decision-making ability which is turn is connected to risk via firm performance. However, this study includes three diversity dimensions like age, education and independent status of directors and their impact on firm risk. This investigation is different from others as there are reasonably lesser studies on Board diversity-risk relationship, whereas most of the predecessor researchers only focus on the one and common diversity dimension i.e. gender diversity but this investigation highlights three dimensions of diversity viz. structural diversity, age diversity and educational diversity which relationship to risk is still unexplored in Indian context. Also, the study not only includes common diversity measures but also adds diversity index to quantify diversity. Further, this study addresses and resolves the contradiction or inconclusiveness in previous research findings. The remaining paper is

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structured in the following manner. Section 2 covers literature survey and hypothesis formulation, section 3 elaborates the research methodology, section 4 focuses on results and discussion, whereas section 5 ends with conclusion and implications.

1. Literature Survey and Hypothesis Formulation

Bhateja (2023) tested the risk-taking power of heterogeneous corporate Board in Indian perspective. The study reported that heterogeneity in respect of education significantly increased the risk management capability of directors but heterogeneity of board experience fails to bring significant effect. Bhat et al. (2020), on the other hand, documented that relationship-oriented (that considers the combined effect of age and gender) and task-oriented diversity (that incorporates the combined effect of education and tenure) brings down the corporate risk in terms of volatility of annualized stock earnings in Chinese market. Harjoto et al. (2018) does not find any association between board relation-oriented diversity (director gender, age and race) and investment variation. However, negative association between Board task-related diversity (director tenure and expertise) and deviation from expected level of investment is observed. The study by Gouiaa (2018) on the relationship between corporate governance systems and enterprise risk management reveals that firms with higher Board independence is better able to manage financial risks. Bernile et al. (2016) looks at different dimensions of diversity and its impact on annualized stock return volatility. The study finds that diversity impacts stock return volatility, which is consistent with diverse background working as a governance mechanism, Berger et al. (2014) highlights the link between board diversity and risk-taking ability in the banking sector. It finds that higher proportion of young and women directors in the board increased risk-taking power of banks, whereas more presence of doctorate degree holders impacted risk-taking capability adversely. The discussion in the sub-points below structures the hypothesis formulation.

1.1 Independent Director and Firm Risk

Many prior researches highlighted that independent directors are the most important instruments in corporate Boards that control and monitor firms in terms of risk management and risk disclosure. According to agency theory, independent directors have low self-serving interest and ability to exhibit higher integrity and therefore render unbiased judgment (AuYong & Tan, 2018). Another view point from agency theory is that independent directors are better able to control the situation of conflict resolution, mitigate ethical hazardous problems and reduce agency costs (Rachdi & Ameur, 2011). So, the monitoring and advisory activities of independent directors provide certainty in return and reduce firm risk. Gouiaa (2018) reported that, controlling and monitoring power of independent director help to absorb excessive risk by implementing strategic and operational corporate decisions. Due to this, firms include outside directors for better internal control and risk management (AuYong &

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Tan, 2018). Younas et al. (2019) find that increasing the proportion of independent directors leads to reduction in corporate risk-taking.

Accordingly, the first alternate hypothesis (H_1) is: Independent directors significantly affect firm risk.

2.2 Age Diversity and Firm Risk

Age diversity refers to the combination of directors of different age groups in corporate board. It is evident from extant literature that age diversity influences firm risk. Risk-taking ability of directors is related to the individual age of board members (Berger et. al., 2014) and heterogeneity of directors' age groups. It creates conflict among board members which leads to diverse opinion and increases risk tolerance (Shalhoub, 2019). It has been observed that young directors adopt risky strategic decisions and are more innovative, technological updated, understand and execute new ideas more efficiently (Cheng et al., 2010). Harjoto et al. (2018) reported that young directors take more aggressive investment decisions than older directors and they also balance aggressive and risk-averse investment decisions and prevent firm risk. Ciavarella (2017) mentions that older group directors are more risk-averse and more experienced, whereas young directors are willing to take higher risk. Finally, Shalhoub (2019) concludes that if the average age of directors increases, it creates an environment where senior directors do not give much heed to the opinion of the young directors' opinions. So, naturally risk perception of aged directors influences firm risk. Thus, age diversity in the Board influences corporate risk.

So, the second alternate hypothesis (H_2) is: Age diversity has significant effect on firm risk.

2.3 Educational Diversity and Firm Risk

Educational diversity is another important task-oriented attribute of board diversity which means combination of directors' educational qualification. It may bring wide range of expertise, variety of ideas and innovation, thereby making Board more effective and inclusive (Ararat et al., 2015). More precisely, diverse educational background provides different viewpoints about corporate goals in board meeting. Bhateja (2023) finds that educational diversity enhances Board effectiveness which can help to manage firm risk. Further, directors' cognitive resources create the potential to increase problem-solving capability, manage different opportunities, take challenges and bring new insights into the corporate Board. This can help to minimize firms' earnings volatility and variation of firm profitability, therefore reducing firm risk (Harjoto et al., 2018). Again, Nielsen and Huse (2010) mentions that since the Board of Directors are specialists and experts, they have the potential to tactically manage and reduce firm risk. Shalhoub (2019) reports that if the educational attainments of directors increase, they become risk-averse because they give more priority towards job, income, reputation and stability career. Interestingly, even directors having

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lower academic qualification focus on job and income security. Thus, educational attainments of director have an impact on corporate risk-taking behavior.

So, the third alternate hypothesis (H_3) is: Educational diversity significantly impacts firm risk.

3. Research Methodology

3.1 Data and Sample

The researchers investigate the relationship between Board diversity and corporate risk-taking behaviour. This is exploratory research based on secondary data collected from the Capitaline corporate database, ACE Equity database and annual report of the firms. The research is based on the study of 25 large-cap and 35 mid-cap companies that however, excludes the banking and financial sector firms due to their different set of regulations and capital structure requirements for these firms under the Banking Regulation Act, 1949 and Companies (Amendment) Act, 2015. The investigation is based on 540 firm-year observations for the period from 2013 to 2021.

3.2 Variable Measurement

3.2.1 Dependent Variables

The researchers consider firm risk as the dependent variable which is quantified using two variables viz. standard deviation of Return on Assets (SD_ROA) and firm leverage (LEV). Standard deviation of ROA represents the attribute of total firm risk, whereas leverage represents the financial risk of firm. For computing total risk of firms, the standard deviation of return on assets is considered based on three-year overlapping window.

3.2.2 Independent Variables

Consistent with the previous studies on board diversity, the study used three proxy measures for capturing age diversity (B_AGE_DIV), which includes percentage of young directors (P_YOUNG_DIR) and percentage of senior directors (P_AGED_DIR) and Blau diversity index (B_AGE_INX). The researchers also consider two proxies to measure educational diversity (B_EDU_DIV) which includes the percentage of professional degree (P_PROF_DEG) holders in the Board and then Blau diversity index (B_EDU_INX) to capture the extent of heterogeneity in the Board. In the case of structural diversity (B_STL_DIV), percentage of independent directors (P_IND_DIR) is used along with Blau diversity index (B_STL_INX). Apart from independent variables, the study also used some control variables, which are categorized under two groups namely, Board-level and Firm-level variables. At the Board level, Board size (B_SIZE) controls for the number of board members at the firm level, the research controls for firm size (F_SIZE), Sales growth (S_GR) and Firm age (F_AGE).

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3.3 Board Diversity Index

For measuring Blau diversity index, the following computation is done:

$$Blau\ index = 1 - \sum_{i=1}^{p} xi^2,$$

Where xi is the proportion of board members in category i and p is the number of categories within the given attribute. The minimum value of Blau Index is zero when all the members are present in only one category, whereas, the maximum value of the index depends on the fraction of members within the defined categories and number of categories within an attribute. For the construction of diversity index, the number of categories for different diversity dimensions is two for structural diversity (independent and non-independent), two for age diversity (those having age less than 54 years and the other exceeding 54 years) and two for educational diversity (professional degree holders and non-professional degree holders). In all these diversity measures where the number of categories is two, the lower and upper limit of the index value is zero and 0.50.

Table 1: Description of Variables

Variables	Label	Description
Firm risk	SD_ROA	The volatility of return on assets over three-year periods
Leverage	LEV	Ratio of total debt divided by total equity
Percentage of Independent Directors	P_IND_DIR	Total no. of independent directors divided by total director in the Board
Blau Structural Index	B_STL_INX	An index of diversity to measure independence status of board
Percentage of Young Directors	P_YOUNG_DIR	Total number of directors of less than 54 years in a particular year divided by total number of directors in that year
Percentage of Aged Directors	P_AGED_DIR	Total number of directors having age above 54 years divided by total number of directors in that year
Blau Age Index	B_AGE_INX	An index of diversity to measure age heterogeneity of board director
Percentage of Professional Degree	P_PROF_DEG	Number of directors holding professional degree in a particular year divided by total number of directors
Blau Educational Index	B_EDU_INX	An index of diversity to measure educational qualification heterogeneity of directors
Board Size	B_SIZE	Natural log of total number of board directors
Firm Size	F_SIZE	Natural log of total firm assets
Sales Growth	S_GR	Percentage of sales growth between year t and year t-1
Firm Age	F_AGE	Natural log of total number of years of firms' operation

Source: Computed by Authors

3.4 Estimated Model using Panel Regression

The estimated regression model is as follows:

$$FIRM\_RISK_{it} = \alpha + \beta_1 B\_STL\_DIV_{it} + \beta_2 B\_AGE\_DIV_{it} + \beta_3 B\_EDU\_DIV_{it} + \beta_4 B\_SIZE_{it} + \beta_5 F\_SIZE_{it} + \beta_6 S\_GR_{it} + \beta_7 F\_AGE_{it} + \varepsilon_{it}$$

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Where i denotes firm, t denotes time dimension, α is the intercept, β_1 to β_8 are coefficients and ε is the error. Firm risk is measured using standard deviation of ROA (SD_ROA) and debt to equity ratio (LEV) used separately in different models. B_STL_DIV is board structural diversity that includes two alternative measures viz. percentage of independent directors on board (P_IND_DIR) and Blau structural diversity index (B_STL_INX). B_EDU_DIV is Board educational diversity that includes two alternative measures viz. percentage of directors having professional degree (P_PROF_DEG) and Blau educational diversity index (B_EDU_INX). B_AGE_DIV is board age diversity that includes percentage of young directors (P_YOUNG_DIR), percentage of aged directors (P_AGED_DIR) and Blau diversity index (B_AGE_INX). In addition, the researchers also control for Board level variable like Board size (B_SIZE) and firm-level variables that include firm size (F_SIZE), sales growth (S_GR) and firm age (F_AGE).

3.5 Models Estimated by Researchers

The researchers estimate the following six models for age diversity and four models for educational diversity as given in table nos. 2 and 3 to check the robustness of findings. The models are as follows:

Table 2: Estimated Models of Age Diversity and Risk

Variable/ Model	M1	M2	M3	M4	M5	M6
Dep. Variable	SD_ROA	SD_ROA	SD_ROA	LEV	LEV	LEV
Ind. Variables	P_IND_DIR, P_YOUNG_DIR	P_IND_DIR, P_AGED_DIR	B_STL_INX, B_AGE_INX	P_IND_DIR, P_YOUNG_DIR	P_IND_DIR, P_AGED_DIR	B_STL_INX, B_AGE_INX
Control variables	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE

Source: Compiled by Researchers, Dep. =Dependent, Ind. = Independent, M=Model

Table 3: Estimated Models of Educational Diversity and Risk

Variable/ Model	M1	M2	M3	M4
Dependent variable	SD_ROA	SD_ROA	LEV	LEV
Independent Variables	P_IND_DIR, P_PROF_DEG	B_STL_INX, B_EDU_INX	P_IND_DIR P_PROF_DEG	B_STL_INX, B_EDU_INX
Control Variables	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE	B_SIZE, F_SIZE, S_GR., F_AGE

Source: Compiled by Researchers, M=Model

4. Results and Discussion

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The results of the study are discussed in the following paragraphs. Initially, descriptive statistics are given after which the results are presented in two sections, the first highlighting the effect of age diversity on risk, and the second to find the effect of educational diversity on risk.

4.1 Descriptive Statistics

The characteristics about the sample can be known from the descriptive statistics as given below.

Table 4: Descriptive Statistics

Variables	Mean	Min	Max	SD
Dependent Variables				
SD_ROA	2.58	0.06	28.56	2.74
LEV	0.33	0	6.20	1.19
Independent Variables				
P_IND_DIR	52.46	13	83	10.99
B_STL_INX	0.48	0.22	0.50	0.05
P_YOUNG_DIR	32.38	0	88	16.80
P_AGED_DIR	67.54	0	100	17.00
B_AGE_INX	0.38	0	0.50	0.11
P_PROF_DEG	65.76	0	100	17.60
B_EDU_INX	0.39	0	0.50	0.12
Control Variables				
B_SIZE	10	3	17	2.68
F_SIZE	16305.82	200.00	277692.10	29533.38
S_GR	10.05	-72.64	226.02	23.94
F_AGE	45.88	6	119	25.04

Source: Compiled by Authors

Table 4 contains mean, standard deviation, minimum and maximum values for all the variables. Corporate risk, measured using standard deviation of ROA, has mean value of 2.58 with minimum and maximum value of 0.06 and 28.56 respectively and standard deviation of 2.74. The study shows that on an average, the debt ratio is 0.33 which means our sample companies maintain healthy debt to equity ratio with a minimum value 0 and maximum value 6.20. The mean percentage of independent directors on the Board is 52% with a range of 13% to 100%. It shows that in some companies, there are few independent directors, whereas in some companies, there is the dominating presence of independent directors. The average of Board structural diversity is 0.48 whose range is 0.22 to 0.50 with a standard deviation of 0.05. The average percentage of young directors and aged directors on the Board is 32.38% and 67.54% with a standard deviation of 17.87% and 17.94% respectively. Whereas the average index of Board age diversity is 0.38 with minimum and maximum values of zero and 0.50 respectively. Similarly, though the mean percentage of professional degree holders on the Board is 65.76% which is quite high, in some companies none of the directors have a professional degree. The analysis shows the mean educational diversity index to be 0.39 with standard deviation of 0.12. The descriptive statistics of control variables show that the average board director is 10 with wide variation as there are both small-sized and large-sized

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Boards. The average firm size based on assets is Rs. 16305 crores with a wide range and a substantially high standard deviation. The sales growth has an average of 10.05% which is reasonable for the sample. Finally, with respect to the firm age, it is observed that on an average, the firms have been in business for a few decades. The firms have a mean age of 45.88 years which shows the presence of matured companies in the sample.

4.2 Results Considering Age Diversity as the Independent Variable

4.2.1 Results of Diagnostic Tests: Model on Age Diversity

Before discussing the panel regression results, the findings of diagnostic tests are looked at to infer whether raw data can be used for model estimation. The results of test for multicollinearity (table 5) shows that there is no strong correlation among the explanatory variables, so data is free from multicollinearity problem as the VIF values lie between 1.03 to 1.23 (threshold limit 10) when age diversity is the independent variable. To test whether the assumption of non-existence of heteroscedasticity is satisfied, Breusch-Pagan test is applied to check the acceptance or rejection of the null hypothesis which states that error term has constant variance. This test is conducted for all the regression models. The results indicate the presence of heteroscedasticity as the null hypothesis is rejected either at 1% or 5% significance level as given in table no. 6 below. Hence, to control for this problem, standard errors are adjusted by employing robust procedure (Fraga & Silva, 2012). Thus, all the regression models are corrected for heteroscedasticity and performed with robust standard errors.

Table 5: VIF Values for Testing Multicollinearity: Models on Age Diversity

Variables	Corporate Risk measure					
	SD (ROA)			LEV		
	M1	M2	M3	M4	M5	M6
P_IND_DIR	1.07	1.06	---	1.07	1.06	---
B_STL_INX	---	---	1.06	---	---	1.06
P_YOUNG_DIR	1.18	---	---	1.18	---	---
P_AGED_DIR	---	1.17	---	---	1.17	---
B_AGE_INX	---	---	1.03	---	---	1.03
B_SIZE	1.23	1.23	1.22	1.23	1.23	1.22
F_SIZE	1.13	1.13	1.14	1.13	1.13	1.14
S_GR	1.06	1.06	1.06	1.06	1.06	1.06
F_AGE	1.07	1.07	1.04	1.07	1.07	1.04
VIF Mean	1.12	1.12	1.09	1.12	1.12	1.09

Source: Compiled by Researchers, M=Model

The researchers present the result of heteroscedasticity test based on Breusch-Pagan test.

Table 6: Heteroscedasticity Result for Age Diversity Models

Description	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
Dependent variable	SD (ROA)	SD (ROA)	SD (ROA)	LEV	LEV	LEV
Chi-sq Value	$\chi2$ (1)= 9.02***	$\chi2$ (1)= 8.80***	$\chi2$ (1)= 12.27***	$\chi2$ (1) = 22.51***	$\chi2$ (1)= 22.57***	$\chi2$ (1)= 23.79***
Prob.	Prob > χ^2=0.0027	Prob > χ^2=0.0030	Prob > χ^2=0.0005	Prob > χ^2 =0.0000	Prob > χ^2=0.0000	Prob > χ^2=0.0000

Source: Computed by Researchers, M=Model *** Significant at 1%, ** significant at 5%, * significant at 10% level

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4.2.2 Model Selection: Age Diversity and Risk

In order to estimate the appropriate regression model, first Restricted F-Test is employed by the researchers to compare between the Pooled Ordinary Least Square Model (Pooled OLS) and Fixed Effect Model (FEM). The investigators find that the test result supports the rejection of null hypothesis as shown in table 7. Hence, the Fixed Effect Model (FEM) is preferred over the Pooled Ordinary Least Square regression model (Pooled OLS). Then, the Breusch-Pagan LM test is employed to select the appropriate model among Pooled Ordinary Least Square Model (Pooled OLS) and Random Effect Model (REM). The rejection of null hypothesis gives the decision in favor of the Random Effect Model (REM). Finally, the Hausman test is employed to select the appropriate model between FEM and REM. The result shows the acceptance of the null hypothesis for models 1 to model 3 but rejects the same for models 4 to 6. Hence, random effect model is the best fit for the first three models, whereas fixed effect model is the best fit for models 4 to 6.

Table 7: Selection of the Appropriate Model for Age Diversity

Purpose	Test	M1	M2	M3	M4	M5	M6
OLS vs FEM	Restricted F-Test	F (59,474) = 3.39***	F (59,474) = 3.39***	F (59,474) = 3.54***	F (59,474) = 16.84***	F (59,474) = 16.83***	F (59,474) = 16.85***
OLS vs REM	Breusch-Pagan LM Test	χ^2 (01) = 81.29***	χ^2 (01) = 81.11***	χ^2 (01) = 86.73***	χ^2 (01) = 673.70***	χ^2 (01) = 671.81***	χ^2 (01) = 673.30***
FEM vs REM	Hausman Test	χ^2 (5) = 6.21	χ^2 (5) = 6.35	χ^2 (5) = 8.53	χ^2 (5) = 150.31***	χ^2 (5) = 194.13***	χ^2 (5) = 15.67***
OLS vs FEM	Null hypothesis: There is no disparity in the intercepts of each sample firms when analyzed individually (ui=0)						
OLS vs REM	Null hypothesis: Existence of a systematic discrepancy in the coefficients (σ^2u=0)						
FEM vs REM	Null Hypothesis: There is no systematic disparity in the coefficient						

Source: Computed by authors, M=Model ***significant at 1% level, ** significant at 5%, *significant at 10% level

4.2.3 Age Diversity and Firm Risk: Panel Regression

The results of panel regression considering firm risk as the dependent variable and age diversity as the independent variable is given in table 8.

Table 8: Regression Result for Age Diversity on Firm Risk

Variables	**SD_ROA**			**LEV**		
	M1 (RREM)	**M2 (RREM)**	**M3 (RREM)**	**M4 (RFEM)**	**M5 (RFEM)**	**M6 (RFEM)**
P_IND_DIR	0.021** (1.99)	0.021** (2.00)	-----	-0.004 (1.21)	-0.004 (1.33)	-----
B_STL_INX	------	-----	0.125 (0.06)	-----	-----	-0.584 (0.98)
P_YOUNG_DIR	0.006 (0.54)	------	------	0.005 (1.39)	------	------

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P_AGE_DIR	-----	-0.005 (0.51)	-----	-----	-0.005 (1.41)	-----
B_AGE_INX	-----	-----	0.653 (0.54)	-----	-----	0.694 (1.38)
B_SIZE	-0.534 (0.81)	-0.534 (0.82)	-0.579 (0.87)	-0.252 (1.38)	-0.252 (1.39)	-0.276 (1.51)
F_SIZE	-0.041 (0.29)	-0.041 (0.30)	-0.057 (0.41)	0.007 (0.10)	0.007 (0.10)	0.017 (0.26)
S_GR	0.003*** (23.79)	0.003*** (23.75)	0.003*** (23.26)	-0.003*** (68.54)	-0.003*** (68.64)	-0.003*** (69.11)
F_AGE	-0.438 (1.01)	-0.440 (1.01)	-0.458 (1.04)	-1.084** (2.02)	-1.082** (2.01)	-1.123** (2.04)

Source: Computed by Researchers
*** indicate significant at 1%, **indicate significant at 5%, * indicate significant at 10% level
Values in the bracket define the t-statistic value (All models based on Robust Standard Error Method)
RREM= Robust Random Effect Model, RFEM= Robust Fixed Effect Model, M=Model.

Table 8 depicts the relationship between age diversity and firm risk. Age diversity is computed using three proxy variables which include percentage of young directors, percentage of aged directors and Blau age diversity, whereas structural diversity is observed using two measures namely percentage of independent directors and Blau structural diversity index. Structural diversity in terms of percentage of independent directors has positive effect on return volatility. Therefore, the greater monitoring role played by independent director shows an escalating effect on risk. Two studies contradict these findings by inferring the presence of independent director in the board reduced firm risk (Akbar et al., 2017, Younas et al., 2019). Whereas, percentage of independent director has negative effect on leverage as depicted in models 4 and 5, but the impact is insignificant. The other measure of structural diversity viz. Blau structural diversity index is positively associated with return volatility but negatively associated with leverage. However, in both the cases, this effect is statistically insignificant as per models 3 and 6.

Homogeneously, the insignificant effect of independent director was reported by Nakano and Nguyen (2012) and Rachdi and Ameur (2011).

With respect to the effect of the diverse age groups in the Board, interesting results are obtained. Though the percentage of young directors has positive effect on return volatility and firm leverage, it is found to be insignificant in models 1 and 4. To check the robustness of the finding, regression equation is separately estimated considering percentage of aged directors as another indicator of Board age diversity. This also shows insignificant effect on the dependent variable. It is observed that the percentage of aged director failed to generate meaningful link with both risk indicators, one of which captures overall risk and the other, financial risk. Similar to the effect of percentage of aged directors, another measure of age diversity viz Blau index shows no significant link between age diversity and firm risk which is measured using both overall risk and financial risk. Similar insignificant findings have been established by other researchers (Harjoto et al., 2018; Shania et al., 2022; Shalhoub,

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2019; Darmadi, 2011). The control variable, Board size has negative effect on firm risk in all the models and reveals insignificant effect in all cases which is consistent with the studies by Shania et al. (2022) and Sattar et al. (2022). Firm size does not reveal significant impact on firm risk in any of the estimated models whereas conversely Bhateja (2023) and Sattar et al. (2022) have found that board size affects firm risk positively and negatively respectively. Though, sales growth shows positive impact on volatility of return and negative impact on debt to equity in all the models, the result depicts weak impact in terms of the coefficient value, though significant at 1% level which is contradictory to the findings in Mohsni et al. (2021) where sales growth impact firm risk insignificantly. Firm age, though does not show significant impact on firm overall risk that is parallel with that of Schopohl et al. (2021), but firm age reveals negative impact on financial risk which is significant at 5% level and gets support in the contribution by Bernile et al. (2018).

4.3 Results considering Educational Diversity as the Independent Variable

4.3.1 Results of Diagnostic Tests: Model on Educational Diversity

The researchers present the VIF values to understand whether there is multicollinearity issue among the explanatory variables of study. The result in table 9 shows that since the values lie between 1.01 and 1.23 which is less than 10, there is no problem in this regard.

Table 9: VIF Values for Testing Multicollinearity: Models on Educational Diversity

Variables	Corporate Risk Measure			
	SD (ROA)		LEV	
	M1	M2	M3	M4
P_IND_DIR	1.01	---	1.01	---
B_STL_INX	---	1.05	---	1.05
P_PROF_DEG	1.04	---	1.04	---
B_EDU_INX	---	1.07	---	1.07
B_SIZE	1.17	1.23	1.17	1.23
F_SIZE	1.12	1.14	1.12	1.14
S_GR	1.09	1.07	1.09	1.07
F_AGE	1.05	1.06	1.05	1.06
VIF Mean	1.08	1.10	1.08	1.10

Source: Computed by Researchers, M=Model.

Similar to the age diversity models, the result on homoscedasticity shows that the null hypothesis is rejected at 1% or 5% significance level (Table 10), thereby pointing to the presence of heteroscedasticity. Hence, here also to control for this problem, standard errors are adjusted by employing robust procedure (Fraga & Silva, 2012). Thus, all the regression models are corrected for heteroscedasticity and performed with robust standard errors.

Table 10: Heteroscedasticity Result for Educational Diversity Models

Description	M1	M2	M3	M4
Dependent variable	SD (ROA)	SD (ROA)	SD (ROA)	Leverage
Test	Breusch-Pagan	Breusch-Pagan	Breusch-Pagan	Breusch-Pagan
Chi-sq Value	$\chi2(1) = 9.47$***	$\chi2\ (1) = 9.16$***	$\chi2\ (1) = 20.29$***	$\chi2\ (1)=23.53$***
Prob.	Prob > χ^2=0.0021	Prob > χ^2=0.0025	Prob > χ^2=0.0000	Prob > χ^2=0.0000

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Source: Computed by Researchers, M=Model. ***significant at 1% level, **significant at 5%, *significant at 10% level

4.3.2 Model Selection: Educational Diversity and Firm Risk

As in the case of age diversity, the same approach is considered here. The detail of the results to choose the best fit model is discussed. At first, the Restricted F-Test is applied to help choose between OLS and Fixed Effect models, after which the Breusch-Pagan LM Test is considered for selecting between OLS and Random Effect model. As per the observed values of chi-squared statistic, the null hypothesis is rejected in both the cases. Hence, for finalizing between the Fixed Effect and Random Effect Models, Hausman test is run. The results given in table 11 shows that in the first two models (Models 1 and 2), null hypothesis is accepted, whereas in the last two (Models 3 and 4), it is rejected. Thus, the Random Effect Model is the best fit model in the first two cases, whereas Fixed Effect Model fits in the last two cases.

Table 11: Selection of Best Fit Model for Educational Diversity

Purpose	Test	M1	M2	M3	M4
OLS vs FEM	Restricted F-Test	F(59,474) = 3.41***	F(59,474) = 3.59***	F(59,474) = 16.19***	F(59,474) = 16.13***
OLS vs REM	Breusch-Pagan LM Test	χ^2 (01) = 82.38***	χ^2 (01) = 91.90***	χ^2 (01) = 696.11***	χ^2 (01) = 675.38***
FEM vs REM	Hausman Test	χ^2 (5) = 6.27	χ^2 (5)= 7.11	χ^2 (5)= 33.98***	χ^2 (5)= 56.48***

OLS vs FEM	Null hypothesis: There is no disparity in the intercepts of each sample firms when analyzed individually (ui=0)
OLS vs REM	Null hypothesis: Existence of a systematic discrepancy in the coefficients ($\sigma^2u=0$)
FEM vs REM	Null Hypothesis: There is no systematic disparity in the coefficient

Source: Computed by Researchers, M=Model. *** Significant at 1% level, **significant at 5% and *significant at 10% level

4.3.3 Educational Diversity and Firm Risk: Panel Regression

The results of panel regression are given in the table below.

Table 12: Regression Result for Educational Diversity on Firm Risk

Variables	**SD_ROA**		**LEV**	
	M1 (RREM)	**M2 (RREM)**	**M3 (RFEM)**	**M4 (RFEM)**
P_IND_DIR	0.019** (2.15)	-----	-0.006** (2.47)	------
B_STL_INX	------	0.380 (0.17)	-----	-0.448 (0.77)
P_PROF_DEG	-0.003 (0.40)	-----	0.002 (0.83)	-----
B_EDU_INX	-----	-0.060 (0.06)	-----	0.228 (0.99)
B_SIZE	-0.572 (0.87)	-0.536 (0.78)	-0.202 (1.19)	-0.201 (1.18)
F_SIZE	-0.044 (0.31)	-0.057 (0.40)	0.017 (0.21)	0.032 (0.39)
S_GR	0.003*** (15.93)	0.002*** (26.10)	-0.003*** (72.08)	-0.003*** (67.63)
F_AGE	-0.459 (1.09)	-0.470 (1.07)	-1.173* (1.73)	-1.207* (1.83)

Source: Computed by researchers ***significant at 1% level, **significant at 5%, *significant at 10% level
Values in the bracket are the t-statistic values (all models based on Robust Standard Error method)

Table 12 shows the impact of educational diversity on firm risk measures viz. ROA volatility and leverage ratio. Educational diversity is measured by two proxy variables, percentage of directors holding professional degree and Blau educational diversity. Similar to the previous model, this model also has two proxy measures of board structural diversity, namely percentage of independent directors and Blau structural diversity index which are considered separately in two different models. Based on the regression result, it can be seen that the percentage of independent directors has positive influence on return on assets volatility but

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negatively on leverage ratio as seen in model 1 and 3 respectively. Though the effect is significant at 5% level, the coefficient values are quite low. The findings of model 1 with respect to Board independence contradicts the inference drawn by Akbar et al. (2017) and Younas et al. (2019). However, the finding of model 3 reveals that the presences of independent directors in the board reduce financial risk which is consistent with the findings of Akbar et al. (2017) and Younas et al. (2019).

In respect of independence, Blau diversity index failed to show any significant impact on firm risk in both models 2 and 4. This finding is in line with Nakano and Nguyen (2012) and Rachdi and Ameur (2011). Table 12 further reveals that percentage of professional degree holders is negatively connected to firms' return volatility as per model 1 but has positive coefficient in model 3. However, in both these cases, the coefficient is statistically insignificant. The other measure of educational diversity, viz. Blau educational diversity index shows negative coefficient in model 2 but positive coefficient in model 4, both of which have insignificant impact on corporate risk. Overall, the discussion finds that the key variables of interest do not reflect significant effect on firm risk. This finding aligns with the studies by Shania et al. (2022), Harjoto et al. (2018). The researchers discuss the findings with respect to the other variables of interest. Board size has negative and insignificant effect on both measures of corporate risk which matches with the findings in Schopohl et al. (2021) and Bhat et al. (2020). The sales growth rate, having significant effect at 1% in all the estimated models shows positive impact on return volatility but negatively on firm leverage which is denied by Mohsni et al. (2021). However, the effect is weak in respect of the coefficient value in all the considered models. Firm size is found to have insignificant effect in all the estimated models. This finding contradicts the result of Mohsni et al. (2021). However, though firm age is found to have insignificant link to return volatility which is corresponds to the outcome of Schopohl et al. (2021), but the effect of firm age is significant at 1% when leverage is taken as the explained variable, similar to the finding in Bernile et al. (2018).

5. Conclusions and Implications of the Study

This study examines the relationship between board diversity and firm risk in India. More specifically, the research looks into the impact of age diversity, educational diversity and structural diversity on corporate risk. The study is done on large-cap and mid-cap companies for the period 2013 to 2021 after the implementation of the Companies Act, 2013. It investigates the link between the age-mix, educational mix and independent status in the Board of Directors and corporate risk. This research uses three proxies of age diversity and two proxies of structural and educational diversity each.

The finding with regard to the effect of structural diversity is interesting and calls for intellectual debate. Results show that structural diversity index has insignificant effect on overall firm risk and financial risk. The structural diversity in terms of percentage of

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independent directors, however, is found to adversely impact return volatility and debt to equity ratio which implies that higher presence of independent directors increases firm risk and financial risk. This result highlights that the role of independent director is found to be non-strategic possibly due to their inability to engage in the regular operational activities and strategic decision-making process because of their part-time status. Furthermore, independent directors fail to bring insider information, which diminishes their impact on internal operations (Khan et al., 2024). Another reason to support the findings is that in many cases, independent directors are selected from the circle of friends or family relationship and by political influence due to which independent directors give more importance towards self-interest than organizational well-being which curtails their risk management ability (Islam & Islam, 2022).

The results with respect to age diversity fail to bring significant impact on overall firm risk as well as financial risk of firm. The possible reason of insignificant effect of age diversity on risk indicates the strong corporate culture in terms of policy making, risk management structure and decision-making process that may nullify the impact of different age groups. Another reason is that corporate risk is more affected by external factors than demographic characteristics like directors' age and educational backgrounds. The educational diversity aspect shows that diversified Board composition has insignificant impact on risk. The insignificant consequence of educational diversity on corporate risk can be explained from the observations of Shania et al. (2022) who observe that practical knowledge becomes more key in running a business than formal academic degrees and hard skills gained from technical / professional courses. Thus, the outcomes of the study give interesting findings which have to be taken care of in framing policies and taking corporate decisions while deciding the mechanism for protecting the interest of shareholders, the most important objective of corporate governance mechanism.

6. Scope for Further Research

In the future endeavors, the researchers can consider other forms of diversity like racial diversity, tenure diversity, and national diversity. Moreover, cross-border studies can be considered to understand how Board diversity changes firms' risk-taking performance in the background of varying cultures, government regulations, economic conditions and capital market maturity. Cross-country studies can help to capture the effect of country-wide differences.

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