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Article

Nexus between board characteristics and financial performance: Evidence from developing economy

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Abstract: Corporate performance is the key indicator of availing the economic performances in all economies. Especially for the emerging economy, it is the oxygen for smooth economic operations. The study aims to investigate the influence of board characteristics on the corporate performance of the listed pharmaceuticals and chemicals sector from a developing country, namely Bangladesh. This empirical study examines eight attributes of the board and four financial performance indicators of the businesses. Here, the annual reports of the DSE-listed pharmaceutical and chemicals companies are considered to examine the impact of board attributes on corporate performance. Based on panel data analysis, this empirical study concludes that the fixed effect regression model is suitable for all four models. Except board size, the results demonstrate that all board attributes are generally statistically significant. Furthermore, it confirms that all the significant characteristics of the board are positively associated with corporate performance, except for board independence. The research offers valuable insights for policymakers, investors, organizations, and scholars, promoting optimal board structures, innovative solutions, and an enhanced understanding of corporate governance matters. This research explores the challenges in board attributes, which enhances our understanding of corporate governance matters and their impact over the last decade in the listed pharmaceutical and chemicals sectors in Bangladesh.

Keywords: board attributes; financial performance; developing country; transparency; sustainable development

1. Introduction

Corporate performance is one of the crucial factors in achieving the sustainability in the operations of business organization. Corporate performance is not only playing its role in micro economic context but also in macro-economic context (Masum et al., 2024). The corporate performance is the corner stone of achieving the acceleration in the economy of a country. Due to these overwhelming significances of corporate performance, factors affecting the corporate performance become a vital issue for both the academicians, regulatory bodies and certainly the organization also (Masum et al., 2024). Without having congenial atmosphere from top management it is quite impossible to achieve the corporate performance in any sort of economies (Rahman and Masum, 2021). This empirical study is conducted to explore the most important factors that bring corporate performance in developing country context. Here board's attributes are used as a proxy of corporate governance to examine their impact on corporate performance from the context of Bangladesh. To explore the impact of the

corporate governance on corporate performance Bangladesh has been chosen as its economy are on the way of graduation from least developing status to developing status. Especially after the impact of COVID-19, the operating performances of the pharmaceutical and chemical industries are comparatively performing better than other industries (Masum et al., 2024). As consequences, it becomes a significant issue to identify the factors that brings the performance in the operation of the pharmaceutical and chemical industries and whether it can be generalized for other industry as well. Moreover in Bangladesh a revised code of corporate governance was adopted in 2018, so definitely this code of corporate governance might have impact on corporate performance. For these circumstances, this empirical study will fill-up the gape of the holistic impact of code of corporate governance in the corporate performance in the context of developing economy, Bangladesh.

Corporate governance is currently seen as a legal requirement in the majority of nations and a significant concern for businesses and organizations (Masum and Khan, 2019; Masum et al., 2024). A well-structured corporate governance system can mitigate power abuse, reduce unnecessary capital spending, and ensure board members possess the necessary credentials and ethical traits (Fariha et al., 2021). The Corporate Governance Code in Bangladesh aims to improve corporate governance for investors, businesses, and the capital market. Businesses listed on any stock exchange in Bangladesh must abide by the conditions outlined in Condition No. 9 of the Corporate Governance Code, Bangladesh (BSEC, 2018). Kaur and Vu (2017) stated that after the Asian financial crisis, it has emphasized the importance of effective corporate governance, particularly in terms of board characteristics, highlighting the role of regulatory authorities and governments. Board characteristics always receive significant attention in corporate governance rules to prevent corporate scandals and fraudulent actions and protect stakeholders' interests (Azar et al., 2014). Al-Absy and Hasan (2023) emphasized the significance of the board's attributes in business success and governance, stating that the board's attributes manage internal control mechanisms and ultimately hold crucial responsibility for an organization's operations and financial success. Al Farooque et al. (2019) argued that board characteristics enhance the quality of reporting and aid in detecting and addressing fraudulent activities since the directors have to ensure the rights and interests of shareholders are protected. Regulatory bodies should prioritize controlling unusual situations and providing optimal guidelines to maintain organizational performance. Companies disclose board attributes as per corporate governance guidelines, aiming to control corporate crises and maintain sustainable performance (Masum and Khan, 2019).

Corporate governance involves agreements and enhancements in environmental, social, and economic areas, requiring collaboration for theoretical advancements, optimal practices, and long-term sustainability (Wang, 2017). Every country and industry should prioritize focusing on corporate governance mechanisms and complying with their rules and regulations for modern challenges (Bhuiyan and Masum, 2010; Hassan et al., 2022). Githaiga and Kosgei (2023) and Oluwatoyin et al. (2021) examined the effect of board qualities on sustainability reporting in African publicly traded companies and highlighted the importance of internal governance frameworks in social and environmental activities for the sustainable performance of the organization. Anas et al. (2023) found a significant disparity in corporate

governance uses and corporate performance prior to and throughout the COVID-19 era. A study explored by Kara et al. (2022) on the influence of board diversity on banks' early response to the COVID-19 pandemic concluded that banks with more diversity on board contribute more to charitable causes and make larger contributions. Therefore, this study aims to examine the influence of board characteristics on the corporate performance of the listed pharmaceuticals and chemicals industry at Dhaka Stoke Exchange, Bangladesh.

This study is divided into five sections: Section 2 outlines the literature review and hypothesis development; Section 3 displays the research methodology; Section 4 describes the findings and discussions of the study; and lastly, Section 5 demonstrates the study's conclusion for diverse users.

2. Literature review and hypothesis development

Corporate governance involves managing and controlling companies and their obligations. Aifuwa and Embele (2019) defined board characteristics, highlighting key attributes such as size, independence, professionalism, diversity, duality, meetings, and committee structure. Financial performance is an assessment of a company's capacity to efficiently utilize its core business wealth and generate income. Researchers (Abdulsamad et al., 2018; Arora and Sharma, 2015; Al-Absy and Hasan, 2023; Hossen et., al, 2023; Kaur and Vu, 2017) used numerous tools as financial performance indicators, such as return on assets, return on equity, net profit margin, and earnings per share, in their studies. According to Al-Absy and Hasan (2023), resource dependency and agency theories play a vital role in examining the nexus between board attributes and financial performance, emphasizing the crucial role of board features in organizations. Several board characteristics have a significant contribution to corporate performance.

2.1. Board size and financial performance

Board size is an important attribute that might have an impact on financial performance (Masum et al., 2024). More qualified board members may bring synergy effect in corporate performance. As per the code of corporate governance 2018, in Bangladesh, the board of a company should have a minimum of five members and a maximum of twenty (BSEC, 2018). The boards are encouraged to be composed of diverse directors (Shamil et al., 2014). Ameen and Mustafa (2022) analyzed the board attributes of Turkey and found a statistically significant and favorable association between the size of the board and the firm's performance. Fariha et al. (2021) revealed a significant and positive association between board size and the return on assets in Bangladeshi publicly listed commercial banks, indicating that larger board sizes significantly influence the bank's performance. A study on corporate governance guidelines and the overall success of the businesses of listed Spanish companies, Fernandez et al. (2014) showed a significant positive connection between board size and corporate performance. Mohammed (2018) also discovered a significant negative correlation between board size and return on equity, highlighting the importance of board features in determining firm performance in Turkey. These inconsistence

findings of the association between the board size and corporate performance pave the way in assuming the following hypothesis:

Hypothesis 1.1: Board size has a significant positive association with ROA.

Hypothesis 1.2: Board size has a significant positive association with ROE.

Hypothesis 1.3: Board size has a significant positive association with net profit margin (NPM).

Hypothesis 1.4: Board size has a significant positive association with EPS.

2.2. Board independence and financial performance

Independence of the board members is one of the key factors that have significant association with corporate performance. Moreover, the independence in board members also provides the opportunity to the business organization to incorporate expert in the operations of the business (Masum et al., 2024). The code corporate governance 2018 mandates a minimum of 20% independent directors on the board of a company, with fractions rounded up to the next whole number. Volonté (2015) highlighted the significant role of independent directors in preventing agency conflicts by providing a reliable monitoring tool and promoting shareholder interests. Independent directors' monitoring and evaluation interests are enhanced when their reputation for inspecting governance operations is based on its significance, influenced by both regulatory and non-regulatory elements (Bøhren and Staubo, 2015). Okolie and Uwejeyan (2022) found that the board's independence significantly and positively influences the financial performance of Nigerian conglomerate businesses. In a study conducted in the Indian banking sector, Kaur and Vij (2017) discovered that the existence of independent directors on the board has a significant negative correlation with the performance of the business. Borlea et al. (2017) stated that there is a significant and negative association between board independence and financial performance. A study on the attributes of directors on board in Palestine by Abdeljawad and Masri (2020) discovered a significant negative relationship between board independence and business performance. These inconclusive findings compel to examine the following hypothesis further:

Hypothesis 2.1: Board independence has a significant negative association with ROA.

Hypothesis 2.2: Board independence has a significant negative association with ROE.

Hypothesis 2.3: Board independence has a significant negative association with NPM.

Hypothesis 2.4: Board independence has a significant negative association with EPS.

2.3. Board professional and financial performance

The inclusion of professionals in board members provides the opportunity to the business organization to incorporate expert in the operations of the business. The BSEC (2018) outlines qualifications for board members, emphasizing the need for at least one of these qualifications, particularly if a professional degree is available. A board of directors composed of highly educated professionals significantly contributes

to an organization's human resources (Mohammed, 2018). Malaysia's rise in corporate misconduct has emphasized the need for financial and accounting specialists to enhance transparency in various matters (Johl et al., 2015). Thuy and Duc (2013) asserted that accounting expertise in compliance significantly influences an organization's performance improvement as it gains more experience. There is a statistically significant positive correlation between professional members on board and real earnings management practices in Nigerian publicly listed financial institutions (Adamu et al., 2017). Mohammed (2018) revealed a significant positive correlation between the percentage of Turkish firms' directors with educational qualifications and their return on equity. Johl et al. (2015) found a significant favorable relationship between the presence of accounting experts and the corporate success of Malaysian publicly listed firms. A comprehensive study reported a significant negative relationship between Tobin's Q and the number of professional body members in Malaysian firms (Azar et al., 2014). Due to these inconclusive findings the following hypothesis has been assumed:

Hypothesis 3.1: Board professional has a significant positive association with ROA.

Hypothesis 3.2: Board professional has a significant positive association with ROE.

Hypothesis 3.3: Board professional has a significant positive association with NPM.

Hypothesis 3.4: Board professional has a significant positive association with EPS.

2.4. Board diversity and financial performance

Board diversity is one of the important factors that provides ample opportunity to the corporate peoples to accumulate diversified thoughts in their operations (Masum et al., 2024). Even diversity in board members will create the opportunity to avail various opportunity offered by the government and regulatory authority (Masum et al., 2024). Kabir et al. (2023) suggests that a diverse representation of women on corporate boards is crucial for an efficient corporate governance structure, which can significantly impact the business. El-Khatib and Joy (2021) suggested that incorporating women on board could significantly enhance corporate performance. Female directors on boards can significantly improve corporate performance, highlighting the unique talents and views that are not found on all-male boards (Bøhren and Staubo, 2016; Boyle and Ji, 2012). Nguyen and Huynh (2023) explore the influence of board attributes on corporate performance using empirical evidence, highlighting a significant positive increase in EPS on Vietnam's stock exchange, based on real-world observations. A comprehensive study explored Jordan's manufacturing sector in terms of the attributes of board characteristics and reported a highly favorable and significant analysis (Amedi and Mustafa, 2020). Terjesen et al. (2016) explored that the diversity of corporate boards across multiple countries and concluded there is a highly favorable and significant impact of female directors on business performance. In their study, Fariha et al. (2021) examine how board qualities impact the performance of listed commercial banks in Bangladesh. They find a substantial

negative correlation between these factors and the return on equity of the banks. Therefore, the following hypothesis has considered in this regard.

Hypothesis 4.1: Board diversity has a significant positive association with ROA.
Hypothesis 4.2: Board diversity has a significant positive association with ROE.
Hypothesis 4.3: Board diversity has a significant positive association with NPM.
Hypothesis 4.4: Board diversity has a significant positive association with EPS.

2.5. Board duality and financial performance

The Board is obligated to clearly define the responsibilities and significant roles of the Chairperson, MD, or Chief Executive Officer. Abdulsamad et al. (2018) recommended that assigning CEO and chairman roles to separate individuals to prevent power consolidation and promote personal interests over company success. According to Blibech and Berraies (2018), if a director manages business as an executive manager, it reduces misunderstandings, enhances adaptability, and leads to long-term success by capitalizing on new opportunities. Isik (2017) found a significant positive association between CEO duality and the financial success of banks, specifically the return on average assets. Palaniappan (2017) studied the Indian manufacturing sector, found a significant positive relationship between CEO and board chair roles and return on equity. Costa and Martins (2019) examined the duality of the board members and discovered a statistically significant and positive association with business performance. Thailand's emerging trends reveal a strong negative correlation between board dualism and financial success, indicating a need for improved governance and oversight (Farooque et al., 2019). These inconclusive findings across the developing nations pave to assume the following hypothesis:

Hypothesis 5.1: Board duality has a significant positive association with ROA.
Hypothesis 5.2: Board duality has a significant positive association with ROE.
Hypothesis 5.3: Board duality has a significant positive association with NPM.
Hypothesis 5.4: Board duality has a significant positive association with EPS.

2.6. Family member on board and financial performance

Family members on board have significant impact on corporate performance especially in the context of South Asian and South East Asian economies (Babu and Masum, 2019; Masum et al., 2024). According to Hussain et al. (2019), family members as directors have access to crucial business knowledge and a broader decision perspective, leading to improved investments and profitability. Family members are more likely to continue running their family enterprises than outside directors, as they have more loyalty to the firm and assume it is part of their properties, which also supports the stewardship theory (Chen et al., 2011). Family members as directors on the board of directors enhance firms' performance by promoting high effort standards and supporting each director's positive commitment to the board (Bettinelli, 2011). Al-Saidi (2021) conducted a comprehensive study based on 89 Kuwait-listed non-financial enterprises from 2017 to 2019 revealed a significant positive relationship between family members on board and return on assets. According to Hussain et al.'s (2019) analysis of the Malaysian study, there is a significant positive correlation between the presence of family-related directors and

financial performance (ROA). Valcanover and Sonza (2023) found a statistically significant positive association between the involvement of descendants on the board and financial performance. A study examining the nexus between family members on board and the performance of Pakistani publicly traded firms concluded an inverse correlation with Tobin's Q (Yasser et al., 2017). Therefore, the following hypothesis has been incorporated in this regard:

Hypothesis 6.1: Family member on board has a significant positive association with ROA.

Hypothesis 6.2: Family member on board has a significant positive association with ROE.

Hypothesis 6.3: Family member on board has a significant positive association with NPM.

Hypothesis 6.4: Family member on board has a significant positive association with EPS.

2.7. Foreign member on board and financial performance

Foreign directors on board can lead to efficient management and take part in strategic thinking, which ultimately enhances the productivity of businesses (Mnzava, 2022). Chinese corporations utilize foreign directors to uphold sustainability standards, especially environmental issues, and enhance their reputation as business entities (Huo et al., 2021). Kilic (2015) concluded that Turkey is raising the number of foreigners on boards due to international mergers and acquisitions, particularly in the banking sector. Consequently, they are contributing to the success of the industry, which aligns with the resource dependence theory. Nguyen (2023) found significant positive relationship between foreign directors on board and business performance in Vietnam. Mnzava (2022) examines the influence of foreign directors on financial performance of 21 publicly traded firms in Tanzania and found significant positive impact in firm performance. Joenoes and Rokhim (2019) found that foreign board members significantly improved corporate performance. A study of the top 200 Chinese companies found that foreign independent directors have a negative effect on the return on assets, which is statistically insignificant (Huo et al., 2021). Based on these inconclusive findings in developing economy the following hypothesis has been incorporated:

Hypothesis 7.1: Foreign member on board has a significant positive association with ROA.

Hypothesis 7.2: Foreign member on board has a significant positive association with ROE.

Hypothesis 7.3: Foreign member on board has a significant positive association with NPM.

Hypothesis 7.4: Foreign member on board has a significant positive association with EPS.

2.8. Board meeting and financial performance

Board meeting is one of the ways of disseminating the decisions of a company. The operational, tactical and strategic decisions of a company are executed through

the board meeting (Masum et al., 2024). The business organization conducts board meetings to maintain a written record of discussions and decisions, with the managing director, secretary, CFO, and head of internal audit and compliance attending (BSEC, 2018). Sahoo et al. (2023) highlight the importance of board meetings for directors to supervise, formulate strategic choices, exchange innovative ideas, monitor management activities, and discuss sustainable goals for better performance. Previous empirical studies explored that increasing board meeting frequency improves strategic decision-making and problem-solving, which boosts corporate performance. The corporate governance policies should prioritize board meeting attendance, active participation, and expertise (Kaur and Vu, 2017). Al Farooque et al. (2019) revealed a significant positive association between board meetings and Tobin's Q of the companies. Nguyen and Huynh (2023) studied 52 Vietnam-listed construction and real estate companies and discovered a significant positive relationship between board meetings and return on assets and return on equity. Al-Daoud et al. (2016) found a significant positive relationship between board meetings and business success. A study by Fernandez et al. (2014) noticed a significant and negative association between the board meeting and the financial performance. Based on these inconclusive findings in developing economy the following hypothesis has been incorporated:

Hypothesis 8.1: Board meeting has a significant positive association with ROA.

Hypothesis 8.2: Board meeting has a significant positive association with ROE.

Hypothesis 8.3: Board meeting has a significant positive association with NPM.

Hypothesis 8.4: Board meeting has a significant positive association with EPS.

3. Research methodology

3.1. Sample, variable, and data source design

The study aims to investigate the influence of board characteristics on the corporate performance of the listed pharmaceuticals and chemicals sector from developing country, namely Bangladesh. This empirical study focused on the pharmaceuticals and chemicals industry as this sector performs well during the last decades evenly including the COVID-19 period (Hossen et al., 2023; Masum et al., 2023). The study investigated the board's involvement and its attributes on business performance throughout the past few years, including the COVID-19 period, from 2013 to 2022. In this study, a purposive sample of 18 listed pharmaceuticals and chemicals companies for tenure of ten years are considered complying with the following conditions:

i) Selected companies must be listed in DSE

ii) Selected company must be a pharmaceutical and chemical company

iii) Companies must publish their annual report regularly

iv) Audited annual reports of the companies are publicly available

As a result, a balanced panel data of 180 audited annual reports is investigated in this study. The study employed four financial performance indicators as dependent variables: return on assets, return on equity, net profit margin, and earnings per share. Additionally, eight board characteristics were considered as independent variables: board size, board independence, board professional, board diversity, board duality, family member on the board, foreign member on the board, and board meeting. Lastly,

company size was included as a control variable. Annual reports are used as the source of data as they are publicly available and audited by the third party (Masum et al., 2024). **Table 1** report the measurements of dependent, independent, and control variables.

Table 1. Measurement of variables.

Variable Type	Name of the Variable	Symbol	Measurement
Dependent Variable	Return on Assets	ROA	Net profit after tax divided by total assets.
	Return on Equity	ROE	Net profit after tax divided by total equity.
	Net Profit Margin	NPM	Net profit after tax divided by total sales.
	Earnings Per Share	EPS	Net profit after tax divided by total number of ordinary shares.
Independent Variable	Board Size	B_SZ	Total number of directors on board.
	Board Independence	B_IN	Independent directors on board divided by total number of directors.
	Board Professional	B_PR	Professional degree holders on board divided by total number of directors.
	Board Diversity	B_DV	Women on board divided by total number of directors.
	Board Duality	B_DT	If any board member holds the chief executive position, then the score is 1; otherwise, the score is 0.
	Family Member on Board	B_FM	If family members are on board, then the score is 1; otherwise, the score is 0.
	Foreign Member on Board	B_FR	If a foreign member is on board, then the score is 1; otherwise, the score is 0.
	Board Meeting	B_MT	Total number of board meetings.
Control Variable	Company Size	C_SZ	Log of total assets.

3.2. Model specification

The study employed panel data analysis with fixed effect model to explore the impact of board attributes on corporate performances. For all the four models Ordinary Least Square (OLS) and Random effect models seems to be inappropriate as the fixed model is best suited for all the four financial performance measurement model. Therefore, to investigate the nexus between board attributes and the financial performance of listed pharmaceutical and chemical companies, the following models are used:

Model 1: $ROA_{it} = \alpha + \beta 1B\_SZ_{it} + \beta 2B\_IN_{it} + \beta 3B\_PR_{it} + \beta 4B\_DV_{it} + \beta 5B\_DT_{it} + \beta 6B\_FM_{it} + \beta 7B\_FR_{it} + \beta 8B\_MT_{it} + \beta 9C\_SZ_{it} + \varepsilon_{it}$

Model 2: $ROE_{it} = \alpha + \beta 1B\_SZ_{it} + \beta 2B\_IN_{it} + \beta 3B\_PR_{it} + \beta 4B\_DV_{it} + \beta 5B\_DT_{it} + \beta 6B\_FM_{it} + \beta 7B\_FR_{it} + \beta 8B\_MT_{it} + \beta 9C\_SZ_{it} + \varepsilon_{it}$

Model 3: $NPM_{it} = \alpha + \beta 1B\_SZ_{it} + \beta 2B\_IN_{it} + \beta 3B\_PR_{it} + \beta 4B\_DV_{it} + \beta 5B\_DT_{it} + \beta 6B\_FM_{it} + \beta 7B\_FR_{it} + \beta 8B\_MT_{it} + \beta 9C\_SZ_{it} + \varepsilon_{it}$

Model 4: $EPS_{it} = \alpha + \beta 1B\_SZ_{it} + \beta 2B\_IN_{it} + \beta 3B\_PR_{it} + \beta 4B\_DV_{it} + \beta 5B\_DT_{it} + \beta 6B\_FM_{it} + \beta 7B\_FR_{it} + \beta 8B\_MT_{it} + \beta 9C\_SZ_{it} + \varepsilon_{it}$

4. Results and discussions

4.1. Descriptive statistics

Table 2 illustrates descriptive statistics for 180 observations of all aspects analyzed in the study. The dependent variables of the study, ROA, ROE, NPM, and EPS, have average values of 10.38, 22.81, 5.16, and 17.24, respectively. The minimum values are −82, −140, −790, and −9, while the highest values are approximately 54, 191, 36, and 171. The standard deviation is approximately 12.72, 35.46, 66.24, and 28.57, indicating favorable post-tax performance for the companies. The board size and independence are averaged at 7.24 and 26.99, respectively, with minimum and highest values of 4 and 12, and 12.5 and 66.67, respectively. The standard deviation for board size is 1.63, and for independence, it is 8.4. The average values of B_SZ and B_IN fall within the specified corporate governance range in Bangladesh. However, the minimal size indicates that at least one of the enterprises does not comply with corporate governance guidelines. The average board professional and diversity values are 18.7 and 21.3, respectively, with a standard deviation of 19.3 and 16.4. The upper limits for B_PR and B_DV are 87.5 and 50%, respectively. The minimal values for B_PR and B_DV are 0%, indicating at least one company with no professional or female directors on board. The board duality, family member on board, and foreign member on board are measured using dummy variables 0 and 1, where 0 means the absence of that indicator and 1 means the presence of that aspect. The mean values of B_DT, B_FM, and B_FR are 0.56, 0.77, and 0.16, respectively. The board meetings have a mean of 8 meetings with a std. deviation of 4, where the min and max values of B_MT are 4 and 24, respectively, indicating a consistent frequency of meetings for each of the companies. The study's control variable, the log of total assets, has an average of 9.6, a standard deviation of 0.667, and a minimum and maximum value of C_SZ of approximately 8.2 and 11.

Table 2. Descriptive statistics.

Variable	Observation	Mean	Std. Dev.	Min	Max
ROA	180	10.381	12.720	−81.67	53.65
ROE	180	22.805	35.456	−140.01	190.7
NPM	180	5.162	66.242	−790.2	36.05
EPS	180	17.240	28.570	−9.24	171.03
B_SZ	180	7.239	1.632	4	12
B_IN	180	26.989	8.402	12.5	66.67
B_PR	180	18.703	19.336	0	87.5
B_DV	180	21.280	16.382	0	50
B_DT	180	0.561	0.498	0	1
B_FM	180	0.767	0.424	0	1
B_FR	180	0.156	0.363	0	1
B_MT	180	8.044	3.966	4	28
C_SZ	180	9.661	0.667	8.18	10.99

4.2. Correlation and collinearity analysis

Table 3 demonstrates the correlation analysis of the research. The analysis shows a negligible positive association between board size and dependent variables ROA, ROE, and NPM and a low positive relationship (0.329) with EPS, all of which are

statistically significant. The study discovered negligible negative associations between board independence and ROA, ROE, and EPS, but a weak inverse relationship with net profit margin, with a statistically significant *r* value of −0.389. There is a low and positive association between board professional and return on assets as well as return on equity, and a moderately positive (0.538) association between and EPS, with a *p*-value of less than 1%. Board diversity has a negligible negative correlation with financial performance indicators such as ROA, ROE, NPM, and EPS, with *r* values of −0.269, −0.188, −0.122, and −0.128, respectively. The correlation between board duality and EPS is statistically significant and low positive, with a coefficient of 0.328, and has a negligible positive relationship with ROA, ROE, and NPM. A family member on board has a significant low negative association with ROA and EPS of −0.443 and −0.442, respectively. A correlation coefficient of −0.544 indicates that there is a moderately negative relationship between B_FM and ROE, which is also statistically significant. A foreign member on board has a statistically significant, moderately positive correlation with ROA, ROE, and EPS, where the values of correlation are 0.634, 0.690, and 0.687, respectively. The last independent variable of the study, board meetings, is negatively correlated with all the dependent variables, and their associations are low in nature.

Table 3. Correlation analysis.

Variable	ROA	ROE	NPM	EPS	B_SZ	B_IN	B_PR	B_DV	B_DT	B_FM	B_FR	B_MT	C_SZ
ROA	1												
ROE	0.825*	1											
NPM	0.598*	0.379*	1										
EPS	0.536*	0.710*	0.114	1									
B_SZ	0.152**	0.228*	0.153**	0.329*	1								
B_IN	−0.159**	−0.053	−0.389*	−0.070	−0.272*	1							
B_PR	0.313*	0.381*	0.105	0.538*	0.466*	−0.114	1						
B_DV	−0.269*	−0.188**	−0.122	−0.128***	−0.173**	−0.004	−0.400*	1					
B_DT	0.054	0.251*	0.095	0.328*	0.075	−0.347*	0.197*	0.197*	1				
B_FM	−0.443*	−0.544*	−0.026	−0.442*	−0.306*	−0.040	−0.457*	0.538*	−0.038	1			
B_FR	0.634*	0.690*	0.083	0.687*	0.135***	−0.008	0.390*	−0.230*	0.102	−0.488*	1		
B_MT	−0.100	−0.234*	0.015	−0.286*	−0.009	0.211*	0.043	−0.227*	−0.570*	−0.014	−0.261*	1	
C_SZ	−0.045	−0.112	0.088	0.083	0.449*	0.064	0.232*	0.064	−0.238*	0.259*	−0.056	0.277*	1

* Significant at 1% level, ** Significant at 5% level, and *** Significant at 10% level.

Table 4 presents the collinearity analysis, focusing on the variance inflation factor and tolerance values. It displays that all VIF values fall within the range of 1 and 3, indicating the absence of multicollinearity. This fits with Masum and Khan's (2019) statement of multicollinearity, which is based on VIF values below 5.

Table 4. Collinearity analysis.

Variable	VIF	Tolerance
B_SZ	2.19	0.456
B_IN	1.34	0.744

Table 4. (*Continued*).

Variable	VIF	Tolerance
B_PR	2.05	0.487
B_DV	1.70	0.589
B_DT	1.97	0.507
B_FM	2.75	0.364
B_FR	1.67	0.598
B_MT	1.89	0.528
C_SZ	2.29	0.436

4.3. Regression coefficients

Table 5 displays the study's regression coefficients, highlighting the *t*-values and beta coefficient values, with star marks indicating the significance of the hypotheses. The study investigated the effect of eight board characteristics on four different corporate performance indicators in the pharmaceuticals and chemicals sectors at Dhaka Stoke Exchange, Bangladesh. Panel data analysis was employed by the researchers. Based on the outcomes of the Breusch and Pagan LM test and Hausman test, researchers determined that the fixed effect model is appropriate for all of the chosen models. The study does not have heteroskedasticity or serial autocorrelation issues. However, there is an issue with outliers, specifically 7 out of the 180 data points. This issue is then solved by employing Cook's distance test. The *R*-squared values for the ROA, ROE, NPM, and EPS models are 0.4315, 0.1704, 0.1899, and 0.1703, respectively. Variations in ROA, ROE, NPM, and EPS can explain 43.15%, 17.04%, 18.99%, and 17.03%, respectively. The study displays that there is a significant negative link between board independence (B_IN) and ROA, ROE, and NPM, with beta coefficients of −0.250, −0.397, and −1.347, respectively, at *p*-values less than 1 and 5 percent. This means that hypotheses H2.1, H2.2, and H2.3 are accepted, which is similar to what Borlea et al. (2017) found. However, there is an insignificant negative correlation between B_IN and EPS. Hence, hypothesis H2.4 is rejected in this study. The variable B_PR demonstrates a significant positive correlation solely with the dependent variable EPS, with a beta value of 0.391 and a *p*-value less than 1 percent. Therefore, reject the hypotheses H3.1, H3.2, and H3.3 and accept only H3.4. Johl et al. (2015) also discovered a significant positive result in their investigation. The relationship between board diversity and both net profit margin and earnings per share is statistically significant at *p*-values < 10% and 5%, where the beta coefficients are −0.628 and 0.492, respectively. The size of the board is positively correlated with the ROA, return on equity, and net profit margin, with coefficient values of 0.336, 0.891, and 3.669, respectively. Conversely, B_SZ exhibits a negative correlation with EPS, with a beta value of −1.340. There is no statistically significant correlation between B_SZ and the dependent variables. Therefore, this investigation rejects the hypotheses H1.1, H1.2, H1.3, and H1.4 and contradicts the outcomes of Fernandez et al. (2014) and Mohammed (2018).

Table 5. Regression coefficients.

Variable	Model-1	Model-2	Model-3	Model-4
Constant	29.464	117.367**	−119.626	−147.063*
	(1.62)	(2.45)	(−1.25)	(−2.69)
B_SZ	0.336	0.891	3.669	−1.340
	(0.74)	(0.74)	(1.53)	(−0.98)
B_IN	−0.250*	−0.397**	−1.347*	−0.198
	(−4.11)	(−2.48)	(−4.21)	(−1.08)
B_PR	−0.047	−0.119	0.102	0.391*
	(−0.98)	(−0.95)	(0.40)	(2.72)
B_DV	0.039	−0.027	−0.628***	0.492**
	(0.58)	(−0.15)	(−1.78)	(2.45)
B_DT	3.546***	14.373*	1.577	2.104
	(1.75)	(2.69)	(0.15)	(0.35)
B_FM	16.621*	7.728	12.897	3.633
	(3.92)	(0.69)	(0.58)	(0.28)
B_FR	6.778*	1.036	−6.132	−2.376
	(3.42)	(0.20)	(−0.59)	(−0.40)
B_MT	0.733*	1.090*	1.007	0.349
	(5.24)	(2.95)	(1.36)	(0.83)
R-SQ	0.4315	0.1704	0.1899	0.1703
Observations	172	172	172	172

* Significant at 1% level, ** Significant at 5% level, and *** Significant at 10% level.

Based on the constructed hypotheses, it can be determined that hypotheses H4.1, H4.2, and H4.3 are not supported. Therefore, hypothesis H4.4 was only considered valid. Terjesen et al. (2016) are consistent with the results of the researchers in this study. B_DT is positively associated with all the dependent variables, and among them, B_DT is only significant with ROA and ROE, where the coefficient values are 3.546 and 14.373 at a *p*-value less than 10% and 1%, respectively. Hence, findings highlighted that hypotheses H5.1 and H5.2 are accepted and H5.3 and H5.4 are rejected in this study. These results are similar to the findings of Costa and Martins (2019). The presence of a family member on board is positively associated with all the models. However, this association is statistically significant only with the return on assets, where the *β*-value is 16.621 at a *p*-value of less than 1%. Hence, hypothesis H6.1 is considered acceptable in this study. These findings align with the outcomes of Al-Saidi (2021).

However, hypotheses H6.2, H6.3, and H6.4 are insignificant. A foreign member on board is positively correlated with return on assets and return on equity, while inversely affecting net profit margin and earnings per share. The significance of B_FR is observed with ROA, which has a *p*-value below 1%. Therefore, hypotheses H7.2, H7.3, and H7.4 are denied, and only hypothesis H7.1 is accepted. Mnzava (2022) also got the same positive and significant findings in his study. The last independent variable, B_MT, has a positive correlation with all the dependent variables in the

research. However, B_MT is only statistically significant in relation to ROA and ROE, with β-values of 0.733 and 1.090, respectively, at a p-value below 1%. Therefore, hypotheses H8.1 and H8.2 are accepted. These results align with the outcomes of Al-Daoud et al. (2016). Nevertheless, hypotheses H8.3 and H8.4 are rejected.

Table 6 demonstrates the summary of the findings, outlining the significant variables and their associations in the study. A perfect board size is always strength of the overall company. B_IN has a statistically significant and negative association with ROA, ROE, and NPM, while its correlation with EPS is insignificant. A board with fewer independent directors can enhance financial performance, as a well-balanced independent director group can help businesses comply with corporate governance and achieve future benefits. The study illustrates a positive relationship between professional board members and earnings per share. As the number of board members with professional degrees increases, businesses can achieve higher earnings per share. Researchers discovered a positive and statistically significant connection between B_DV, the proportion of women on a board, and EPS. A higher number of female members on board can lead to increased earnings per share. Diversified boards generate more new ideas, contributing to a corporation's growth and governance beyond what a single-focused board can achieve. A director who also serves as the chief executive position has a positive correlation with firm performance, particularly in terms of return on assets and return on equity. The inclusion of both family members on a board and foreign members on a board significantly and positively improves business performance by enhancing communication, fostering innovative ideas, and integrating diverse cultural perspectives. The board meeting, a crucial aspect of corporate governance, is positively correlated with the return on assets and return on equity. Increased board meetings improve organizational oversight and financial performance evaluation. Therefore, firms should prioritize board meetings for sustainable management and performance.

Table 6. Summary of hypotheses.

Variables	Constructed Hypothesis	Rejected Hypothesis	Accepted Hypothesis
B_SZ	H1.1, H1.2, H1.3, & H1.4	H1.1, H1.2, H1.3, & H1.4	None
B_IN	H2.1, H2.2, H2.3, & H2.4	H2.4	H2.1, H2.2, & H2.3
B_PR	H3.1, H3.2, H3.3, & H3.4	H3.1, H3.2, & H3.3	H3.4
B_DV	H4.1, H4.2, H4.3, & H4.4	H4.1, H4.2, & H4.3	H4.4
B_DT	H5.1, H5.2, H5.3, & H5.4	H5.3 & H5.4	H5.1 & H5.2
B_FM	H6.1, H6.2, H6.3, & H6.4	H6.2, H6.3, & H6.4	H6.1
B_FR	H7.1, H7.2, H7.3, & H7.4	H7.2, H7.3, & H7.4	H7.1
B_MT	H8.1, H8.2, H8.3, & H8.4	H8.3 & H8.4	H8.1 & H8.2

5. Conclusion

The study examines the effect of board attributes on the financial performance of listed pharmaceutical and chemical companies in developing economy Bangladesh. The study revealed that all the board characteristics are statistically significant in at least one of the four models, except one board attribute, which determines the effectiveness of board characteristics on sustainable performance. The study reveals

that the total number of directors on a board does not significantly impact company performance, indicating that organizations can choose to follow the local corporate governance guidelines of their country. The findings of the study provide valuable insights for policymakers, enabling them to create an optimal board structure that balances stakeholder concerns. Organizations and investors may continuously seek innovative solutions to maximize profits, and scholars may propose new ideas to enhance their understanding of corporate governance matters by using this research.

This study has some limitations that can be addressed by further study. Firstly, further study can be executed by incorporating more industries rather the pharmaceutical industry. Secondly, a multi country context might provide more meaningful outcome in the association between the board attributes and corporate performances. Thirdly, incorporating new corporate governance elements like ownership attributes may add further values in the arena of corporate governance. Fourthly, some mediating variables can be used to measure the strengthens of the relationship between the board attributes and corporate performance. Finally, a qualitative study like observations, interviews, and perceptions of board attributes on corporate performances may provide more insight in the literature of corporate governance and corporate performances.

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