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Corporate Governance Mechanisms and Board Characteristics as Determinants of Financial Failure: A Cox Proportional Hazards Model

Duha Jamal Rabaia[1], Abdulnaser Ibrahim Nour[1,*], Muiz Abu Alia[1], Hassan Kanj[2], Mouhammad AlAkkoumi[2], Kamel Jebreen[3,*]

[1] *Faculty of Business and Communication, Department of Accounting, An Najah National University, Nablus, Palestine*
[2] *College of Engineering and Technology, American University of the Middle East, Egaila 54200, Kuwait*
[3] *Faculty of Applied Sciences, Palestine Technical University - Kadoorie, Hebron, Palestine*

Abstract. This study aims to predict corporate failure (CF) using the statistical forecasting method, employing R. It also seeks to investigate the impact of corporate governance mechanisms (CG) and the characteristics of board directors (BC) on CF. The study examined 480 annual reports from industrial and service firms listed on the Palestine and Jordan Stock Exchange markets, totaling 7,200 inputs. The research utilized a survival approach and the Cox hazard regression model. The study found a significant negative association between board size, board independence, board education, board age, firm size, and liquidity, considered together, and CF. Conversely, there is a significant positive association between profitability and CF. The log-likelihood test results indicated that the CG and BC models are significant. To the authors' knowledge, this study is the first in Palestine and Jordan to focus on the statistical prediction of financial failure, bridging a gap in the existing literature by understanding the association between governance indicators and board features on one hand, and financial failure on the other. Additionally, this study distinguishes itself as one of the pioneering studies within the accounting domain to adopt a survival approach, traditionally prevalent in medical research. It is also one of the few researches that use the R Language in the accounting and business field.

2020 Mathematics Subject Classifications: 91G80, 91B82, 62N02, 62P25, 62M10, 62-07

Key Words and Phrases: Corporate failure; Corporate Governance; Board of directors' characteristics; Cox Proportional Hazards Model; RStudio

*Corresponding author.
*Corresponding author.
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Email addresses: Duha.Rabaia@gmail.com (D. J. Rabaia), a.nour@najah.edu (A. Nour), muizabualia@najah.edu (M. AA), hassan.kanj@aum.edu.kw (H. Kanj), Mouhammad.A@aum.edu.kw (M. AK), Kamel.Jebreen@ptuk.edu.ps (K. Jebreen)

1. Introduction

Over the past decades, there have been numerous instances of corporate failure (CF) in the business world, a phenomenon that has attracted a lot of attention from academic and professional areas. Researchers have determined a range of factors contributing to these failures, including operational threats [1], unfavorable economic conditions, and weaknesses in corporate governance (CG) and board efficiency [2], are responsible for these failures. Financial manipulations and mismanagement are frequently identified as triggering drivers of CF, which creates an enormous risk to the survival of companies[3]. notably, financial crises such as Enron, WorldCom, Parmalat, Nortel, and Tyco underscore the adverse effects of the weakness of CG and fraudulent accounting practices on financial failure [4, 5]. In response, we have observed a rise in awareness of contemporary firms' CG practices. According to the Agency theory perspective, positions CG is essential in mitigating conflicts (agency cost) arising from the separation of ownership and management [6]. At its core, CG also seeks to meet the requirements of all shareholders encompassing owners, suppliers, Creditors, consumers, bank, the state, distributors, staff, and other key stakeholders [7]. Good CG fosters trust, transparency [8], openness, accountability, financial stability, promoting long-term investment, and business sustainability [9]. However, CG is a crucial factor in management decisions, reflecting on firm success and survival or failure [10]. Meanwhile, behavioral science theories — such as upper echelons theory, human cognition theory [11], theory of diversity [12], and information processing theory [13] — highlight the critical association between board characteristics (BC) and decision-making, directly reflecting on firm's survival prospects. Historically, CF has been predicted using traditional quantitative models, such as the popular Altman, Kida, and Sherrod models, with variable degrees of reliability [4, 14]. Despite their popularity, these models frequently have limitations such as a weakness in prediction accuracy, notably the Altman model the most famous model - their reliability rates range from 75 to 90%, inconsistent data, changeable significance, poor categorization, and restricted applicability [15, 16]. Furthermore, the findings of previous empirical evidence on the impact of CG and BC on CF are inconsistent. Moreover, most studies focus on developed countries with similar structural contexts, necessitating further research to elucidate the impact of CG and BC on CF, excessively in the developing and emerging world.

The predominance of family-based firms in emerging markets [17, 18], brings forth complex challenges such as conflicts of interest and the prioritization of family interests that increase agency conflict. These challenges underline the crucial need for research into CG practice and BC attributes and their impact on financial failures in these markets. Effective CG can serve as a counterbalance to these challenges, ensuring that the interests of all shareholders are protected and that the firm operates with a greater degree of transparency and accountability. This, in turn, can minimize the failure risk, which is of paramount importance for the stability and growth of emerging markets. The research utilizes the Palestinian and Jordanian markets as samples of emerging economies [19, 20]. In this context, the historical, cultural, and legal intertwining of Palestine and Jordan presents a unique opportunity to explore the influence of CG and BC on CF, providing

valuable lessons for similar developing and emerging economies worldwide. This study specifically focuses on the scenario of Palestine and Jordan, motivated by the countries' relative cultural and social congruence [21, 22]. This similarity is further entrenched by the political factors, wherein the West Bank was under Jordanian administration from 1950 to 1989 [23, 24]. During this period, many administrations of municipal, institutions and corporations moved from the capital, Jerusalem, to the capital, Amman [25]. Additionally, Jordanian laws, including the Jordanian Companies Law, were applied in Palestine, a practice that remains in effect, in the West Bank [26]. Furthermore, the same trend behavioral patterns among the individuals of these neighboring countries, alongside their geographical proximity, provide a unique comparative framework, the London-based Oxford Business Group stated that at least two-thirds of Jordan's population were of Palestinian origin, the Palestinians, actually the Jordan largest ethnic groups is Palestinian [26]. On the other hand, the existence of Jordanian and Palestinian corporations that operate branches across both territories underscores the relevance of enhancing the conduct of unified and comprehensive research on these intertwined cultural, behavioral, economic, and legal environments.

Despite the problem of financial failure being a relatively new area of study, there is a significant lack of research addressing it. Furthermore, to the best of the researcher's knowledge, no comparable investigations have been carried out in emerging countries, particularly in Palestine or Jordan. Moreover, CF is influenced by several board attributes, including age and education; yet research on how these factors directly affect CF remains unexplored. Thus, this study embarks on an analytical journey to forecast the financial failure of firms listed on the Palestine Exchange (PEX) and the Jordan Exchange (ASE) through statistical methodologies, utilizing the R programming language. In addition, it aims to investigate the impact of corporate CG indicators and BC on CF. However, this study focuses on CG indicators, including; board size, board independence, chief executive officer (CEO) duality, ownership concentration, ownership structure, and audit committee existence, as well as BC, encompassing board age, gender diversity, board education, and board activity. The critical idea of the study posits that these CG and BC indicators play a pivotal role in shielding firms from financial distress, ultimately averting bankruptcy and enhancing firms' survival within the market. Such resilience contributes to the broader national economic welfare and prosperity. Regardless, this study makes several significant contributions; firstly, it pioneers the prediction of CF through statistical methods rather than traditional quantitative models, which have fluctuating accuracy. Secondly, it elucidates the significance of CG in ensuring the survival of firms. Thirdly, it highlights the influence of board attributes in safeguarding firms against CF. Fourthly, it advocates for the adoption of the R/RStudio programming package in accounting, recognizing R's prowess in statistical analysis. Fifthly, it introduces the use of survival methodology in the accounting field, a technique predominantly utilized in medical research. Sixthly, it integrates various theoretical perspectives such as agency theory, resource dependence theory, upper echelon theory, and theory of diversity, thereby enriching the theoretical underpinnings of the study and improving the link between behavioral science theories on one hand, and economic theories on the other. Lastly, by focusing on the under-researched

contexts of emerging markets, this research fills a critical void in the literature.

The paper is organized as follows for the remainder of it: Section two presents the literature review and hypotheses development. Section three clarifyies the research methodology encompassing the research sample, data sources, empirical model, and variable measurement. Empirical results and discussion are provided in section four. Section five offers a conclusion, recommendations, and scope for future studies.

2. Theory, Literature Review and Hypotheses Development

2.1. Characterizing Terminology

CG, as defined by the Organization for Economic Co-operation and Development (OECD) encompasses the relationships among a firm's management, board, shareholders, and stakeholders, as well as the mechanisms for setting and achieving its objectives [9]. It includes principles, practices, laws, and procedures aimed at improving corporate regulation [27]. Initially conceptualized in the Cadbury report, CG focuses on governing and guiding firms to safeguard stakeholder interests [28]. Good CG enhances economic performance, productivity, and investor trust, with implications for economic growth and attracting venture capital [9]. It improves access to external funding, lowers capital costs, and enhances operating performance, providing mechanisms for foreign investors to protect against insider excesses [29]. The study of Mugarura [30] summarizes CG philosophy as evaluating compliance with legislation, rules, and procedures, with well-structured CG systems ensuring the firm's priorities and interests are met. Efficient CG structures foster trust, encouraging investment and facilitating the proper functioning of the business economy[9, 31]. However, The fundamental goal of any firm is the ability to survive and continue [32]. Failure, within the financial context, encompasses various meanings. It may refer to financial disparities hindering a firm's ability to meet its obligations in the short term [33]. It could entail an increase in debt leading to reduced revenue and insufficient cash flow for operations. The stage of financial failure begins early, starting with the firm defaulting on payments and fulfilling its obligations, until it reaches the stage of complete bankruptcy, according to [34]. Bankruptcy represents the pinnacle of CF, indicating that costs exceed assets, and owners face continued losses [35]. Financial failure occurs when a firm collapses due to inadequate income generation [36]. Internal factors contributing to financial losses include inefficient operations, technology shortages, and poor management practices [37]. External factors such as capital scarcity, market perception, and economic conditions also play a role. Financial losses can render a firm insolvent, prompting the need for strategies to improve its position.

2.2. Corporate Governance and Corporate failure

The integration of agency theory within a theoretical framework provides valuable insights into the association of CG and CF. Agency theory holds that the board of directors' strong monitoring of executives reduces conflicts of interest between shareholders and management [38]. This oversight enhances management performance, particularly that of

the CEO, and increases share value, thereby reducing the potential risk of financial failure [4]. The primary responsibility of the board of directors is to ensure the survival of the firm [39]. Furthermore, Mugarura [30] argues that the global economic crisis revealed a strong link between CG and corporate collapse, citing examples like Northern Rock and Enron, which suffered from weak internal audit credibility, poor CG structures, and inadequate risk management practices. Empirical evidence on the association between CG and CF is inconsistent. Süsi & Lukason [40] found that in the Estonian market, the risk of failure decreases with manager age and management ownership but increases with larger boards and executive involvement. Liang and others [41] studied CG indicators in Taiwan, including cash flow rights, ownership structure, board composition, and concentration, highlighting board composition as the critical factor in bankruptcy prediction. However, the current research selected six factors as indicators of CG mechanisms – board size, board independence, CEO duality, ownership concentration, ownership structure, and audit committee existence to research their impact on the CF. Therefore; the following main hypothesis was developed:
H_A: There is a significant impact of corporate governance mechanisms on corporate failure.

2.2.1. Board Size

Board size, or the number of directors on a firm's board, is an important component of CG. Agency theory [42] states that boards are essential in keeping an eye on management actions to safeguard the interests of shareholders. While smaller boards may have difficulties with monitoring and conflicts of interest, which raises the likelihood of firm failure, larger boards may provide diversified experience and efficient oversight [4]. Moreover, larger boards have better linkages to outside parties, which increases their access to resources, according to the resource dependency hypothesis [43]. Large boards can help with resource access, but even while they have an impact on management decisions, they can also cause power disputes and impede crisis decision-making [40]. Smaller boards also frequently increase productivity and lower the chance of business failure. Results from empirical research on board size and CF are not always consistent. While some, like [44, 45], observe that non-failed firms frequently have larger boards, others, like [40], find a significant impact of higher board size on increased CF. However, research by [7, 46] finds no evidence of a substantial relationship between board size and failure risk. Consequently, the subsequent sub-hypothesis was developed:
H_{A1}: There is a significant impact of board size on corporate failure.

2.2.2. Board Independence

The independence of directors is a key component of corporate governance. Often called non-executive directors, independent directors have no financial or personal ties to the business or its management [47]. As per Jensen and Meckling [42], agency theory posits that elevated levels of board independence are positively correlated with improved firm performance and lower failure rates [38]. Additionally, the theory holds that boards of

directors are essential in overseeing and controlling managerial conduct to protect shareholder interests. Due to their independence from management, independent directors are more likely to behave impartially and in the best interests of the shareholders. Consequently, it is posited that increasing the number of independent directors on the board will have a favorable effect on decreasing the probability of firm failure [4]. This viewpoint is supported by research by Bukar, which contends that outside directors may reduce conflicts and encourage managers to adopt tactics that increase shareholder value [48, 49]. Empirical studies on the connection between corporate failure and board independence, however, produce mixed results. However [4, 47], identified a positive correlation between the chance of failure and independent directors. Moreover, Süsi and Lukason found a higher incidence of financial misconduct in firms with fewer outside directors [40]. Furthermore, [50] and [51] found negligible correlations between board independence and firm failure. Thus, the following sub-hypothesis was formulated:
H_{A2}: There is a significant impact of board independence on corporate failure.

2.2.3. CEO Duality

Research on the controversial topic of whether the Chairman of the Board (COB) should function as the CEO is still ongoing, and it is a topic of much discussion in the CG literature. According to stewardship theories, which support the convergence of various responsibilities, unified leadership fosters streamlined accountability and improves firm effectiveness [52]. On the other hand, agency theory highlights how important role segregation is in supporting board independence [53]. As supported by Fama and Jensen, the concentration of decision-making power in one person may result in decreased board efficiency, which could have a long-term negative impact on the success and survival of the firm [38]. This viewpoint is supported by studies conducted by Xu and others, which indicate that dividing the positions helps to ensure independence and reduce the likelihood of CEO misconduct [54]. Empirical evidence, however, yields inconsistent findings. Rajeevan and Ajward, for example, raised concerns about governance when they discovered a positive correlation between CEO-chair duality and earnings management in Sri Lankan enterprises [55]. On the other hand, Ciampi found a statistically significant inverse relationship between CEO duality and SME failure, suggesting possible hazards related to CEO-chair duality [46]. Nonetheless, CEO duality was determined by [5] to have a negligible effect on the CG. Thus, the following sub-hypothesis formulated:
H_{A3} : There is a significant impact of CEO duality on corporate failure.

2.2.4. Ownership Structure

The Ownership structure factor represents a pivotal aspect of CG and is widely studied for its impact on financial outcomes [56]. Fama and Jensen emphasize the critical role of ownership structure in safeguarding shareholder rights and enhancing firm performance. According to agency theory, the separation of ownership and management may lead to conflicts of interest, as managers could prioritize personal gains over shareholder interests [38]. Boards with higher ownership percentages are believed to mitigate agency costs by

aligning the interests of shareholders and management [42]. Empirical evidence, however, reveals a nuanced relationship between ownership structure, managerial behavior, and firm financial results [56]. For instance, [57] discovered a significant positive association between director ownership and financial distress, consistent with entrenchment theory, which posits that insiders prioritize self-interest over shareholder value, ultimately affecting firm survival. Also, Studies by [58] support this perspective, observing that firms with high insider ownership often underperform, suggesting a potential link between ownership concentration and poor financial outcomes. Conversely, [48] identified a negative relationship between ownership structure and financial failure, indicating a potentially protective effect of certain ownership arrangements. Thus, the following sub-hypothesis was formulated:
H_{A4} : There is a significant impact of ownership structure on corporate failure.

2.2.5. Ownership Concentration

Concentrated ownership, characterized by large shareholders holding the majority of a firm's shares, fosters active shareholder engagement and monitoring of managerial activities, reducing the risk of financial failure [40, 59]. Moreover, ownership concentration can also mitigate agency issues by enabling shareholders to appoint representatives to oversee managerial actions, ultimately enhancing firm performance [46]. Additionally, Saggar and Singh support this perspective, arguing that ownership concentration reduces information asymmetry and principal-agent conflicts, leading to increased transparency and disclosure [60]. However, major shareholders with concentrated ownership may exert influence by appointing preferred candidates to board and executive positions, shaping decision-making processes [61]. Empirical research supports the beneficial impact of concentrated ownership on firm performance and risk reduction [62]. Furthermore, [63, 64] found that lower ownership concentration is a valuable maximize a firm's performance, so the higher concentration reflects positively in corporate failure. On the other hand, [46] and [65] found that ownership concentration is negatively associated with business failure. Others suggest an insignificant association, as seen in the research by [40]. The following sub-hypothesis was formulated:
H_{A5}: There is a significant impact of ownership concentration on corporate failure.

2.2.6. Audit Committee

The presence of a strong audit committee is crucial for effective CG, aligning with principles of agency theory aimed at mitigating conflicts between owners and agents [66]. Audit committees enhance board efficiency by ensuring audit quality, maintaining independence in nominations, and considering compensation matters [67]. They oversee financial statements, supervise executives, and strengthen accounting standards, thereby enhancing the firm's credibility and mitigating risks [68, 69]. However, internal conflicts within audit committees can adversely affect a firm's financial position, contributing to real earnings management and fraudulent reporting practices [70], which negatively affect firm survival.

Nevertheless, studies consistently demonstrate a negative correlation between audit committee activities and corporate failure, thereby enhancing the consistency of CG and crisis prevention [7, 63]. Conversely, [71] suggest that the establishment of an audit committee may lead to increased management control, potentially resulting in financial distress. Furthermore, some studies find no significant correlation between the presence of an audit committee and firm failure [72]. The following sub-hypothesis was formulated to further investigate this relationship:
H_{A6}: There is a significant impact of the audit committee on corporate failure.

2.3. Board of Directors Characteristics and Corporate Failure

Within the ambit of organizational behavior and management theory, the Upper Echelons Theory posits a significant correlation between the aggregated characteristics of senior management teams and the overall performance and success of firms. This theoretical framework has notably illuminated the discourse on firm behavior, especially through the seminal work of Hambrick and Mason titled "Upper Echelons: The Organization as a Reflection of Its Top Managers." The authors of this pivotal study advocate that the intricacies of strategic decision-making predominantly emerge from behavioral dynamics rather than from purely systematic or economic considerations [73]. The exploration of Board attributes and their consequential impact on CF has been a focal point of research, driven by the premise that these characteristics are instrumental in determining a firm's trajectory toward success or failure. Platt and Platt, delve into the nexus between executive board traits and firm bankruptcy, proposing five board compositions and nine elements as representative proxies [45]. Their findings underscore that companies steering clear of bankruptcy typically feature larger, older boards, a higher number of independent directors, an increased presence of seated CEOs, and a leaner management structure in contrast to their bankrupt counterparts [45]. Furthering this line of inquiry, Saggar and Singh accentuate the critical role of board characteristics in shaping decision-making processes [60]. They identify gender, age, technical background, and education as key components of BC. Anchored in this scholarly groundwork, the present study selects four distinct attributes of the board of directors—namely, board age, board gender diversity, board education, and board activity—to scrutinize their influence on the CF. Consequently, the following main hypothesis was formulated:
H_B: There is a significant impact of board characteristics on corporate failure.

2.3.1. Board Age

Age diversity on boards is less explored compared to gender and race [74]. According to the upper echelons theory, managers' characteristics such as directors' age influence firm survival [73]. The argument suggests that a mixed-aged board ensures an efficient division of labor, where older members contribute experience, mid-aged members handle executive responsibilities, and younger members learn and bring fresh perspectives. Senior directors, due to their experience, closely monitor executives, thereby reducing financial risk [54].

Additionally, a higher average board age has been associated with reduced CEO engagement in financial misconduct [75]. However, Murray suggests that homogeneous boards with similar values achieve goals more effectively [76]. while Mahadeo and Soobaroyen, argue for board age heterogeneity (specifically, ages 36–55) to maximize firm value [77]. Research on the relationship between board age and CF yields inconsistent results. Senior board members have been found to positively correlate with increased business value so negatively correlate with CF [40, 45]. However, [78] found a negative association between senior board age and firm survival, while Jhunjhunwala Mishra, reported insignificant results [79]. Therefore, the following sub-hypothesis was formulated to investigate this inconsistency further: The following sub-hypothesis was formulated:
H_{B1}: There is a significant impact of board age on corporate failure.

2.3.2. Board Gender Diversity

Gender diversity on boards has been extensively researched, with studies suggesting various benefits. The human cognition and information processing theories propose that diverse entities can lead to better decisions due to increased information richness [11, 13]. Female representation enhances directorship resources, especially in stressful situations [80]. Women's active engagement in discussions during strategic decision-making positively impacts firms [7]. The upper echelons theory suggests that board members' views influence judgments, and gender diversity can enhance decision-making by introducing diverse perspectives [73]. However, diversity theory indicates that greater similarities lead to shared outcomes and fewer conflicts [12]. Studies such as Chen et al. (2018) found that female representation correlates with increased creativity and productivity, particularly in innovative industries. Additionally, [81] argue that female directors, along with their educational background, reduce the likelihood of fraud. Conversely, other studies suggest that males are more likely to be overconfident, while women are perceived as more emotional and sensitive, which could reflect negatively on firm performance [82]. Thus, the following sub-hypothesis was formulated:
H_{B2}: There is a significant impact of board gender diversity on corporate failure.

2.3.3. Board Education

Educational diversity, which refers to the range of expertise and skills based on academic backgrounds, is a crucial aspect of group dynamics [83]. The upper echelons theory suggests that demographic factors like education impact strategic decision-making [73]. While diverse educational backgrounds on boards are believed to enhance decision-making [84]. Research findings on the relationship between education and CF vary. Some studies suggest that the presence of PhD members may not positively affect firm success, so educational degrees associate with higher failure rates [77, 85], while others find a negative link between education and failure [84, 86] However, some studies suggest an insignificant relationship between educational degree and financial failure [87, 88]. Thus, the following sub-hypothesis was formulated:
H_{B3}: There is a significant impact of board education on corporate failure.

2.3.4. Board Activity

The frequency of board meetings is a crucial factor affecting a firm's performance and its vulnerability to financial collapse risks. More frequent meetings, especially during uncertain times, enable better management of issues like earnings manipulation [89, 90]. However, excessively frequent meetings may signal awareness of financial troubles, potentially leading to failure problems [91]. Despite their importance, many boards meet infrequently, with some discussing critical issues without management's participation [67]. Jensen questioned the effectiveness of such meetings, noting that CEOs often control the agenda, limiting directors' ability to monitor performance and strategy [92]. Board activity tends to be reactive, increasing after poor performance [92]. Boards may convene more frequently during major events like mergers or restatements, reflecting a need for strategic guidance [93]. However, increased board activity can negatively impact firm value if driven solely by compliance or litigation avoidance [93]. Studies show that board meetings negatively affect earnings management methods that will lead to more financial risk [94, 95] and have a positive association with financial distress [96, 97]. Thus, the following sub-hypothesis was formulated:
H_{B4}: There is a significant impact of board activity on CF.

3. Database and Research Method

3.1. Research Design

The survival methodology, previously utilized in studies by [98–100], was adopted to achieve the research objective. Survival analysis methods were employed to analyze various characteristics' influence on events leading to failure [101]. The Cox proportional hazards model, initially used in medical research, was adapted for financial research [102]. This model predicts the time of a firm's failure, aiming to classify bankruptcies close to the original bankruptcy time [102]. Parker utilized survival analysis methods to examine the relationship between CG attributes, financial ratio, and distressed firms' likelihood of survival [99]. Similarly, [103] applied survival analysis using the Cox hazards model to determine the effect of CG indicators and financial characteristics on continuing finances.

3.2. Data and Research Sample

The research sample encompasses all industrial and service firms meeting the following criteria: firstly, the firm must be listed on the PEX, and the ASE during the period from 2015 to 2019. Secondly, the firm should not have been bankrupt, merged, or liquidated during this time. Thirdly, the necessary data must be available, constituting more than 7,200 Excel entries. Table 1 represents the study sample. The data required for this research were manually collected. The necessary data to measure CG variables include board size, board independence, CEO duality, ownership structure, ownership concentration, and audit committee existence. Furthermore, BC variables, such as board age, board gender diversity, board education, board activity, and firm status (failed/non-failed), were

obtained from the annual reports published on the PEX and ASE websites [104, 105]. The only exception is the ages of board members variable for Palestinian boards, which was obtained from the Palestinian Civil Registry. It is crucial to recognize that the period from 2020 to 2023 was intentionally omitted from the sample. This beneficial exclusion was undertaken to reduce the likelihood of confounding effects of the unprecedented COVID-19 pandemic, which could significantly affect (direct and indirect) the financial failure. Furthermore, by excluding this period, we aimed to ensure the integrity and accuracy of the data analysis -by isolating the pre-pandemic from post-pandemic periods- we sought to capture a clearer picture of the accurate direction played by the board of directors in influencing the financial failure.

Table 1: Summary of the Study Sample

Market	Sector	Before exclusion	After exclusion	%
PEX	Industry	13	12	12.50
	Services	10	9	9.70
ASE	Industry	34	34	35.40
	Services	43	41	42.70
Total		100	96	100%

3.3. Empirical Models

The study further applies Cox hazard regression, a non-parametric technique, which was chosen due to its robustness to non-normal distributions, which may be present in CG and BC mechanisms [99, 106–108]. The Cox proportional hazards model estimates parameter values by comparing the proportional impacts on the hazard rate with a baseline hazard. The hazard rate represents the probability of a specific event (bankruptcy) occurring at the next instant, given that it has not occurred up to that point in time [40, 99]. Parameter estimation is based on the rankings of firms with common CG and BC, resulting in distinct probabilities of conditional distress. Each independent variable coefficient in the model measures the change in the hazard rate with a one-unit change in the variable, holding all other variables constant. The hazard ratio (HR) indicates the impact on the likelihood of business failure or distress associated with a one-unit change in the independent variable. A hazard ratio of 1 implies no impact on the probability of business failure, while a hazard ratio of less (more) than 1 indicates a lower (higher) risk of failure or default [40, 99]. In the current study, two Cox hazard regression models were formed. Model I assesses the impact of CG indicators on the CF. The general form of the model is specified through the following regression econometric equation:

$$CF_{it} = a_0 + \beta_1 \text{ BSIZE }_{it} + \beta_2 \text{ BINDEP }_{it} + \beta_3 \text{ DUALITYY }_{it} + \beta_4 OWNERS_{it} + \beta_5 \text{ OWNERC }_{it} + \beta_6 \text{ AUDITC }_{it} + \beta_7 \text{ FSIZE }_{it} + \beta_8 \text{ LIQUD }_{it} + \beta_9 \text{ PROFIT }_{it} + \varepsilon$$

Model II assesses the impact of the board of director's attributes on CF, through the

following regression Equations:

$$CF_{it} = a_0 + \beta_1 BAGE_{it} + \beta_2 BGENDER_{it} + \beta_3 EDU_{it} + \beta_4 BACTIV_{it} + \beta_5 FSIZE_{it} + \beta_6 \text{ LIQUD }_{it} + \beta_7 \text{ PROFIT }_{it} + \varepsilon$$

Where; the a_0 is the intercept; β_1 to β_9 represent the slope of independent variables. The subscripts i and t connote firms and the duration since the firm establishment age; ε presents error terms; SIZE is the board size; BINDEP is board independence; DUALITY is board duality; OWNERS is ownership structure; OWNERC is ownership concentration; AUDITC is audit committee existence; FSIZE is firm size; LIQUD is liquidity and PROFIT is profitability.

3.4. Variables Measurement

In this study, CF is identified as the dependent variable. Financial failure is defined, following [99], as a series of consecutive defaults resulting in long-term losses. This situation leads to a firm's liabilities surpassing its assets, thereby diminishing its ability to fulfil payment obligations. Drawing on prior studies, such as that by [34], and the aforementioned definition of financial failure, a firm is deemed to have failed if there is a reduction in its cash flow from operating activities over consecutive fiscal years [99]. Conversely, CG and BC serve as the independent variables in this research. These dimensions encompass board size, gender diversity, age, independence, education level, CEO duality, ownership structure, ownership concentration, audit committee presence, and board activity level. Building upon the groundwork laid by prior studies, including [3, 40, 46, 109, 110], this investigation further scrutinizes the influence of liquidity, profitability, and firm size as control variables on CF. This analytical extension is predicated on the recognition that these factors exert a substantial effect on CF, as evidenced across the majority of related literature. This potential effect means the managerial predispositions towards employing various accounting manipulations—such as 'big bath' accounting, income smoothing, 'cooking the books', and earnings management—to advance personal interests, thereby impacting the firm's survival or precipitating its failure. These manipulative practices, which result in distorted figures within official financial statements, necessitate a nuanced examination of their implications for firm performance. Accordingly, Table 2 presents variables measurement.

Table 2: Proxies of the Research Variables

Variable	Measurement	References
Dependent Variable		
Corporate failure	If the firm failed, then "1"; otherwise, "0"	([4, 111])
Independent Variables (CG and Board Features)		
Board size	Number of the board of directors	([109])
Independence	Percentage of non-executive directors on the board	([112, 113])
CEO duality	If CEO and chairman roles are separated, then "1"; otherwise, "0"	([113, 114])
Ownership structure	Percentage of shares held by managers	([115, 116])
Ownership concentration	If one owner has over 50% of the shares, then "1"; otherwise, "0"	([40])
Audit committee	If the audit committee exists in the firm, then "1"; otherwise, "0"	([117, 118])
Board age	The average age of board members	([119])
Board gender	The number of female members divided by board size	([31, 109])
Board education	The proportion of members with a master's degree or PhD to the total number of board members	([120, 121])
Board activity	Frequency of board meetings per year held annually	([122, 123])
Control Variables (Firm-Specific Features)		
Firm size	The natural log of total assets of the firm	([124])
Profitability	Net income / Total assets	([112])
Liquidity	Current assets / Current liabilities	([125, 126])

4. Empirical Results and Discussion

4.1. Descriptive Statistics

Descriptive statistical techniques, related to all the research dimensions, including dependent variable, independent variables, and control variables are presented in Table 4 & 5. In addition, supplementary tables for research analysis are represented in Appendixes.

Table 3: Frequency Distribution

Variables	**Categories**	**2015**	**2016**	**2017**	**2018**	**2019**
Financial Failure	Failed	20 (21.1%)	22 (22.9%)	21 (21.9%)	30 (31.2%)	10 (10.4%)
	Non-Failed	75 (78.9%)	74 (77.1%)	75 (78.1%)	66 (68.8%)	86 (89.6%)
CEO Duality	Duality	8 (8.4%)	10 (10.4%)	4 (4.2%)	4 (4.2%)	6 (6.2%)
	No Duality	87 (91.6%)	86 (89.6%)	92 (95.8%)	92 (95.8%)	90 (93.8%)
Ownership Concentration	High	27 (28.7%)	28 (29.5%)	29 (30.2%)	31 (32.3%)	30 (31.6%)
	Low	67 (71.3%)	67 (70.5%)	67 (69.8%)	65 (67.7%)	65 (68.4%)
Audit Committee	exists	72 (78.3%)	76 (81.7%)	86 (89.6%)	86 (89.6%)	87 (90.6%)
	No exist	20 (21.7%)	17 (18.3%)	10 (10.4%)	10 (10.4%)	9 (9.4%)

Table 4: Descriptive Statistics

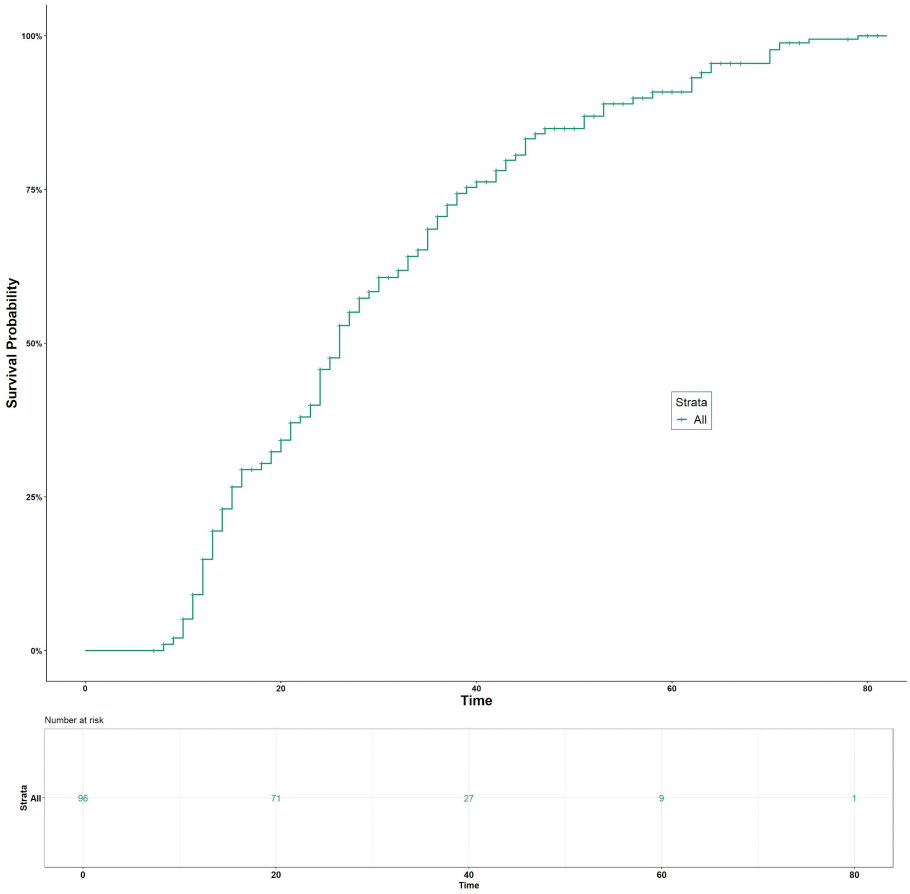
Variables	Year	n (miss)	Mean	SD	Median (Q1-Q3)	Min	Max
Board Size	2015	96 (1)	8.4	2.6	$8(7-10)$	4	15
	2016	96 (0)	8.3	2.5	7 (7-10)	5	15
	2017	96 (0)	8.4	2.6	7.5 (7-10.25)	5	15
	2018	96 (0)	8.6	2.5	9 (7-10.25)	5	15
	2019	96 (0)	8.3	2.5	$8(7-10)$	4	13
Board Gender	2015	96 (1)	0	0.1	0 (0-0)	0	0.4
	2016	96 (0)	0	0.1	0 (0-0)	0	0.4
	2017	96 (0)	0	0.1	0 (0-0)	0	0.4
	2018	96 (0)	0	0.1	0 (0-0)	0	0.4
	2019	96 (1)	0	0.1	0 (0-0)	0	0.3
Board Age	2015	96 (4)	55.8	7.4	55.6 (50.36-60.6)	39.4	74.8
	2016	96 (3)	55.9	7.6	54.9 (49.92-60.7)	40.4	74.2
	2017	96 (3)	57.1	7.2	57.3 (52-61.7)	41.4	76.7
	2018	96 (3)	56.4	7.6	55.6 (50.86-61.3)	39.7	78.4
	2019	96 (3)	57	7.4	57 (51.43-62.3)	40.2	76.3
Board Independence	2015	96 (1)	0.9	0.1	1 (0.86-1)	0.4	1
	2016	96 (0)	0.9	0.1	0.93 (0.86-1)	0.1	1
	2017	96 (0)	0.9	0.1	1 (0.86-1)	0.1	1
	2018	96 (0)	0.9	0.1	0.97 (0.86-1)	0.1	1
	2019	96 (0)	0.9	0.1	1 (0.86-1)	0	1
Board Education	2015	96 (2)	0.4	0.2	0.37 (0.2-0.53)	0	0.9
	2016	96 (2)	0.4	0.2	0.38 (0.21-0.47)	0	0.9
	2017	96 (2)	0.4	0.2	0.39 (0.24-0.5)	0	1
	2018	96 (2)	0.4	0.2	0.4 (0.22-0.45)	0	1
	2019	96 (3)	0.4	0.2	0.4 (0.23-0.5)	0	1
Ownership Structure	2015	96 (5)	0.5	0.3	0.45 (0.23-0.71)	0	1
	2016	96 (5)	0.5	0.3	0.43 (0.24-0.71)	0	1
	2017	96 (5)	0.5	0.3	0.48 (0.26-0.71)	0	1
	2018	96 (5)	0.5	0.3	0.5 (0.27-0.73)	0	1
	2019	96 (5)	0.4	0.3	0.47 (0.22-0.69)	0	1
Board Meeting	2015	96 (26)	7.3	2.9	6 (6-8)	0	19
	2016	96 (26)	7.6	3	6 (6-8.75)	1	17
	2017	96 (6)	7.6	2.9	6 (6-9)	0	17
	2018	96 (3)	7.5	3	6 (6-9)	0	19
	2019	96 (3)	7.4	2.5	7 (6-9)	0	15
Firm Size	2015	96 (1)	17.3	1.4	17.2 (16.4-18)	13.8	21
	2016	96 (0)	17.3	1.4	17.2 (16.4-17.96)	13.8	20.9
	2017	96 (0)	17.3	1.4	17.2 (16.5-18)	13.8	21
	2018	96 (0)	17.3	1.5	17.2 (16.4-17.97)	13.8	21.1
	2019	96 (0)	17.3	1.4	17.24 (16.5-18)	13.7	21
Liquidity	2015	96(1)	9.5	69.7	$1.62(0.96-3)$	0.1	681.2
	2016	96(0)	11.8	91.9	$1.91(0.97-3.11)$	0	902.2
	2017	96(0)	4.7	24.2	$1.57(0.88-2.9)$	0	238.1
	2018	96(0)	3	9.2	$1.4(0.88-2.78)$	0.1	89.9
	2019	96(0)	6.2	36	$1.44(0.82-2.81)$	0	353.4
Profitability	2015	96(1)	0.1	0.1	$0.05(0-0.09)$	-0.6	0.6
	2016	96(0)	0.1	0.1	$0.04(0.01-0.08)$	-0.3	0.6
	2017	96(0)	0	0.1	$0.04(0-0.08)$	-0.2	0.6
	2018	96(0)	0	0.1	$0.03(0-0.07)$	-0.2	0.9
	2019	96(0)	0	0.1	$0.02(0-0.06)$	-0.4	1

According Table 3, 4 5, in 2015, 21.9% of the sampled companies were classified as failed, but this percentage decreased to 10.4% by 2019, indicating an improvement in overall company performance. The mean board size remained relatively stable over the years, with most companies complying with CG regulations dictating a board size of at least five members. Similarly, board independence remained consistent, with the majority of companies including independent directors on their boards, aligning with CG principles. The separation of CEO and chairperson roles was prevalent across the years, suggesting a commitment to governance best practices. Regarding ownership structure, the percentage of shares held by managers fluctuated around 40%, indicating a balanced distribution of ownership. The presence of audit committees increased steadily over the years, reflecting growing awareness of their importance in CG. Board age and education remained relatively constant, with a diverse range of educational backgrounds among board members. However, gender diversity remained low, possibly reflecting cultural norms. Board activity levels were consistent, reflecting adherence to CG guidelines. Control variables such as firm size, liquidity, and profit showed stable mean values across the years, indicating consistent financial performance metrics. Overall, these findings underscore the evolving landscape of CG and board dynamics in the PEX and ASE, highlighting areas of improvement and adherence to regulatory standards.

4.2. Cox Proportional Hazards Regression

The displayed figure is a Kaplan-Meier survival curve, which is a statistical tool commonly used in medical studies to estimate survival probabilities over time for a special group (8,25,122–129). However, Figure 1 below illustrates the survival curve for firms including all the current variables. In short, the vertical axis represents the survival (failure) probability, ranging from 0% to 100%. The horizontal axis represents time in years (Prediction for the future) depending on the establishment date for all firms. Below the chart, there is a table showing the "Number of risk," which refers to the number of firms at risk (i.e., the number of firms still surviving through the future years). We can note in general, that the number of firms decreases over time, indicating that firms either experienced the event of failure.

Figure 1: Survival/Failure Curve



According to the curve reveals an initial precipitous decline in survival probability, suggesting that younger firms face a higher risk of financial failure early in their existence. As time advances, the survival probability levels off, indicating that firms that have weathered the initial turbulent phase of their lifecycle are less likely to succumb to financial distress, potentially due to the maturation of their CG and BC. Notably, the 'number at risk' metric declines with each downward step of the curve, which corresponds to a company failing financially. This visualization underscores the hypothesis that the older firms, possibly in conjunction with effective CG and BC practices, are a determinant of financial fortitude. It suggests that firms with a longer operational history—implying the potential for well-established governance structures and experienced boards—are more resilient in the face of financial adversities. However, the results of the Cox proportional hazards regressions overall using CF as a dependent variable are shown in Table 5.

According to Table 5, the Cox regression statistical analysis results indicate that larger board sizes and increased board independence significantly reduce corporate financial failure risk, with P-values of 0.001 and 0.01 , and hazard ratios of 0.88 and 0.17 , respectively,

Table 5: Cox Hazards Regression

Variables	**Event Ratio**	**Hazard Ratio**	**(95% CI)**	**P Value**
Corporate Governance				
Board size	< 1	0.88	(0.81, 0.95)	¡ 0.001
Board independence	< 1	0.17	(0.05, 0.65)	0.01
CEO duality	> 1	1.09	(0.50, 2.36)	0.83
Ownership structure	> 1	1.06	(0.49, 2.29)	0.88
Ownership concentration	> 1	1.3	(0.85, 2)	0.23
Audit committee	> 1	1.5	(0.87, 2.57)	0.14
Board Characteristics				
Board age	< 1	0.93	(0.90, 0.95)	¡ 0.001
Board gender	< 1	0.06	(0.00, 2.27)	0.13
Board education	< 1	0.19	(0.06, 0.57)	¡ 0.001
Board activity	> 1	1.02	(0.94, 1.09)	0.68
Control Variables				
Firm Size	< 1	0.77	(0.67, 0.89)	¡ 0.001
Liquidity	< 1	0.03	(0.01, 0.15)	¡ 0.001
Profitability	> 1	1	(1.00, 1.01)	¡ 0.001

aligning with H_{A1} and H_{A2}. Furthermore, CEO duality, ownership structure, concentration, and audit committee presence show insignificant positive associations with CF , suggesting a minimal impact on financial survival; opposing $H_{A3}; H_{A4}; H_{A5}$, and H_{A6}. On the other hand, board age and education significantly correlate with reduced CF risk, with strong statistical significance, these findings supporting H_{BI} and H_{A3}. However, board gender has a negative insignificant impact on CF. Additionally; board activity has a positive but insignificantly influence on CF , indicating their limited statistical impact on CF ; reject H_{BI} and H_{B4}. Moreover, firm size and liquidity have a negative significant impact on CF , while profit has a positive significant impact on failure risk. This underscores the potential impact of earnings management practices that managers may follow for various goals, including achieving personal interests, by manipulating the value of profits. However, the study delves into the intricate relationship between corporate CG and BC with corporate CF, employing Cox hazards regression analysis to explore how each element such as board size, independence, CEO duality, ownership structure and concentration, audit committee presence, board age, gender diversity, education, and activity, influence the likelihood CF. The significant negative correlation between board size and CF underscores the advantage of larger boards, which likely stems from their broader diversity in knowledge and experience, enhancing oversight and company performance, reflecting on firm status. This result is consistent with those of [44] and [45]. Similarly, board independence emerges as a critical factor for CG, aligning with agency theory by suggesting that independent boards mitigate conflicts of interest between shareholders and management, thus fostering a more robust governance framework; this agrees with [40]. In contrast, CEO duality represents an insignificant positive relationship with CF .

The positive direction aligns with stewardship theories, which support the convergence of various responsibilities, unified leadership fosters streamlined accountability and improves firm effectiveness [52], this trend is supported by [52]. Also, the study result was consistent with [127] who found an insignificant association. The current work analysis indicates that ownership structure and ownership concentration increase, and the likelihood of financial failure also increases support [57, 63]. This relation is against the agency theory perspective, which suggests higher ownership percentages are believed to mitigate agency costs by aligning the interests of shareholders and management [42]. The hypothesis results (insignificant) are consistent with the results of [40, 56] revealing a nuanced relationship between ownership structure; concentration, and firm financial results. Furthermore, the study challenges traditional assumptions about the role of audit committees, showing an insignificant positive association with CF and suggesting that the effectiveness of these committees in enhancing financial integrity may depend more on their operational effectiveness than their mere presence. The positive direction result agrees with the study of [71]. In addition, the current paper agrees with [4] who found no significant relationship.

The findings related to board age and education significantly contribute to the reduced CF , indicating that experience and knowledge within the boardroom are pivotal for reducing the risk of financial failure. This result aligns with the studies of [54, 75] that recommend that senior directors, who possess greater age and experience, are more likely to closely monitor the activities of executives. Additionally, individuals holding higher degrees are

considered the most efficient in the company. They are more capable of understanding the circumstances and making optimal decisions to ensure the company's survival. This assertion is supported by [40, 45, 84, 86]. Additionally, the experimental findings in this research fail to support the cognitive theories which state that diverse groups make better decisions because they possess more information [11, 13]. The research by [128] shows that female involvement in strategic discussions enhances firm survival yet the high uncertainty in this study prevents researchers from validating this effect. The research results differ from earlier studies which demonstrated gender diversity's substantial impact on CG [81, 129]. Furthermore, the findings regarding board activity remain somewhat ambiguous; however, they suggest a negative impact on a company's survival. This result is quite surprising, indicating that the frequency of board of directors' meetings in companies from Palestine and Jordan may have inadvertently contributed to an increased risk of company failure, albeit to an insignificant degree. This phenomenon is corroborated by [92, 130], who posited that board activity tends to be more reactive than proactive, with boards convening more frequently following poor performance. Moreover, the effectiveness of these meetings is called into question, as they are typically orchestrated by the CEO, who determines the agenda and discussion points, potentially leading to inadequate monitoring and assessment of the CEO's performance. This positive correlation between board activity and the likelihood of company failure is also consistent with the findings of [96, 97, 131], which further supports the unexpected relationship that suggests increased board activity does not necessarily equate to improved company health. This insight prompts a critical reassessment of board meeting efficacy and the prevailing governance

practices within these markets.

4.3. Results of Log-Likelihood Test

The log-likelihood test serves as a statistical tool to evaluate parameter additions through chi-squared distribution analysis for determining significance. Table 6 shows that corporate governance CG and BC models successfully explain variations in CF according to the results.

Table 6: CapLog-Likelihood Testtion

Models	$\mathbf{R^2}$	P value
Model 1: CG	0.048	0.001
Model 2: BC	0.0591	0.001

The Log-Likelihood Test analyzes model fit through a comparison of two models which relies on Maximum Likelihood Estimation and Chi-Squared distribution to establish if new variables boost predictive power. The CG model demonstrates 4.8% CF variation prediction accuracy and the BC model shows 5.9% accuracy which both achieve significant P -values (0.001) thus validating H_A and H_B. These findings reinforce the robustness of the study model, demonstrating that adding CG and BC enhances rather than complicates the analysis. The results align with Agency theory [38] and upper echelons theory [132], which emphasize the role of executive demographics and board Characteristics in shaping corporate performance and survival. Research findings gain additional support from this theoretical approach which concludes that leadership structure represents an essential factor for financial stability and resilience. However, Table 7 clarifies the summary of the research results and testing hypotheses decision.

Table 7: Summary of the Results and Testing Hypotheses Decision

Variables	H_X	Significant		Insignificant		Decision
		Positive	Negative	Positive	Negative	
Corporate Governance	H_A	Yes				Accept
Board size	H_{A1}		Yes			Accept
Board independence	H_{A2}		Yes			Accept
CEO duality	H_{A3}			Yes		Reject
Ownership structure	H_{A4}			Yes		Reject
Ownership concentration	H_{A5}			Yes		Reject
Audit committee	H_{A6}			Yes		Reject
Board Characteristics	H_B	Yes				Accept
Board age	H_{B1}		Yes			Accept
Board gender	H_{B2}				Yes	Reject
Board education	H_{B3}		Yes			Accept
Board activity	H_{B4}			Yes		Reject
Firm size			Yes			-
Liquidity			Yes			-
Profitability			Yes			-

5. Conclusion

This study aimed to predict the financial failure of firms in Palestine and Jordan using statistical methods within the R programming environment. It also explored the impact of CG indicators and Board attributes on failure. Governance factors included board size, board independence, CEO duality, ownership structure, ownership concentration, and the presence of an audit committee. BC variables were assessed based on board age, gender diversity, educational level, and activity level. Firm size, liquidity, and profitability were included as control variables. The sample consisted of 96 Palestinian and Jordanian firms from the industrial and service sectors. Employing survival analysis methodology and Cox proportional hazards regression analysis, the study tested its hypotheses. The results indicated that approximately 10% of the firms in Palestine and Jordan were classified as failed in 2019. The governance indicators accounted for 4.8% of the variance in CF, while BC variables explained 5.9% of the variance in CF.

Additionally, the analysis revealed that board size, board independence, board age, board education firm size, and liquidity were significantly and negatively associated with CF. In contrast, a significant positive association was found between profitability and CF. These findings elucidate the pivotal variables influencing financial failure and underscore the nuanced impact of governance and board dynamics on financial outcomes. The research recommends enforcing the mandatory application of the Corporate Governance Code in Palestine, updating it for clearer details on board members' diversity. Regulators should establish an official CG index, encouraging firms to disclose comprehensive board

member information. Reviewing legislation on board size and implementing controls on CEO duality is crucial. Defining a maximum ownership percentage and supervising the audit committee can enhance transparency. Emphasizing board diversity, holding higher educational qualifications, and efficient meetings further contribute to effective CG. To the best of the authors' knowledge, this study, the first in Palestine and Jordan, focuses on financial failure statistical prediction, bridging the gap in the existing literature by understanding the association between CG, and BC on the one hand and CF on the other. Additionally, this study distinguishes itself as one of the pioneering studies within the accounting domain to adopt a survival approach, traditionally prevalent in medical research. Furthermore, it is one of the few researches, which uses R Language in accounting and business fields. Finally, this research combines behayioral theories, management science, and economics.

The study have many practical implications. The first implication of this research is that investors can utilize the findings to assess failure based on governance and board indicators. Secondly, the insights gained from this study can aid decision-makers in circumventing risks that may precipitate firm failure, thus enhancing the likelihood of firm survival. Thirdly, the study serves as a valuable resource for regulatory authorities in the development of new policies about CG and BC. Furthermore, this research stands as a guideline, encouraging scholars to employ the RStudio program in their analytical endeavors. This research encompasses several limitations. First, a universally agreed-upon index is absent for evaluating compliance with CG practices. Second, the study did not measure all characteristics related to board members, such as their rotation and experience. Third, the sample size is relatively small. However, to augment and refine the results of this research, future studies are encouraged to explore additional variables that may impact CF, especially during the current COVID-19 crisis. Moreover, investigating the relationship between the characteristics of the audit committee and CF is recommended. Additionally, employing artificial intelligence methods to predict financial failure could provide valuable insights.

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Data Availability

The data is available upon request from the corresponding author.

Appendix

Supplementary material and research sample details are listed in the following link `https://drive.google.com/file/d/1ezldX5pbYiG2r-Yr4mR206QfuORY8jOG/view?usp=sharing`

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