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EXPLORING THE IMPACTS OF FINANCIAL FAILURE RISK ON SUSTAINABLE GROWTH POLICIES: EVIDENCE FROM THE BIST SUSTAINABILITY INDEX COMPANIES[*]

Finansal Başarısızlık Riskinin Sürdürülebilir Büyüme Politikaları Üzerindeki Etkileri: BIST Sürdürülebilirlik Endeksi Şirketlerinden Kanıtlar

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Keywords: Sustainable Growth, Financial Failure Risk, BIST Sustainability Index, Panel Data Analysis

JEL Codes: C33, G32, G33, Q56

Abstract

This study investigates the impacts of financial failure risk on firms' sustainable growth policies using econometric analysis and aims to identify suitable financial failure models for the sustainable growth policies developing process. The study covers data from 38 non-financial firms listed in the Borsa Istanbul Sustainability Index (XUSRD) for 2010-2022. Sustainable growth is calculated by Higgins's (1977) sustainable growth rate (HSGR), while financial failure risks are assessed through Altman's (1983) Z'-score, Springate (1978) S-score, Taffler (1983) T-score, Fulmer et al. (1984) H-score and Legault (1987) CA-score models. The econometric approach employs a five-stage panel data methodology, including the pre-tests of multi-collinearity, cross-sectional dependency, slope homogeneity, stationarity, autocorrelation, and heteroskedasticity. Panel regression results reveal positive relationships between financial success and sustainable growth. However, the statistical significance of these relationships varies across different financial failure models. The effects of T and H-scores are statistically significant, whereas Z', S, and CA-scores do not exhibit statistically significant effects. Consequently, the findings suggest that T and H-score models should be prioritized in sustainable growth policy development.

Anahtar Kelimeler: Sürdürülebilir Büyüme, Finansal Başarısızlık Riski, BIST Sürdürülebilirlik Endeksi, Panel Veri Analizi

JEL Kodları: C33, G32, G33, Q56

Öz

Bu çalışma, finansal başarısızlık riskinin firmaların sürdürülebilir büyüme politikaları üzerindeki etkilerini ekonometrik analiz yoluyla belirlemeyi ve sürdürülebilir büyüme politikaları geliştirme sürecinde kullanılabilecek uygun finansal başarısızlık modellerini tespit etmeyi amaçlamaktadır. Çalışma, Borsa İstanbul Sürdürülebilirlik Endeksi'nde (XUSRD) işlem gören finansal olmayan firmaların 2010-2022 dönemi verilerini kapsamaktadır. Sürdürülebilir büyüme politikaları Higgins (1977) sürdürülebilir büyüme oranı (HSGR) kullanılarak, finansal başarısızlık riskleri ise Altman (1983) Z'-score, Springate (1978) S-score, Taffler (1983) T-score, Fulmer ve diğerleri (1984) H-score ve Legault (1987) CA-score modelleri kullanılarak ölçülmüştür. Ekonometrik çerçeve çoklu doğrusal bağlantı, yatay kesit bağımlılığı, eğim katsayılarının homojenliği, durağanlık, otokorelasyon ve değişen varyans ön testleri ve panel regresyon analizi dahil olmak üzere beş aşamalı bir panel veri metodolojisi içermektedir. Panel regresyon sonuçları, finansal başarısızlık riski ile HSGR arasında pozitif ilişkiler olduğunu ortaya koymaktadır. Ancak, bu ilişkiler tüm finansal başarısızlık modelleri için istatistiksel olarak anlamlı değildir. Sonuçlar, Z', S ve CA skorlarının sürdürülebilir büyüme politikaları üzerinde istatistiksel olarak anlamlı etkilerinin olmadığını, T ve H skorlarının etkilerinin ise istatistiksel olarak anlamlı olduğunu göstermektedir. Bulgular, sürdürülebilir büyüme politikalarının geliştirilmesinde T-skor ve H-skor modellerinin diğer modellere göre tercih edilmesi gerektiğini göstermektedir.

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1. Introduction

Climate change, global natural resource scarcity, extreme poverty, demographic shifts, and evolving economic and financial conditions profoundly influence how organizations envision the future (Karaçayır and Afşar, 2024). The concepts of corporate social responsibility (CSR) and corporate social performance (CSP) have gained prominence amid inquiries into companies' obligations to stakeholders beyond solely maximizing investor profits. There's a growing recognition of the significance of fostering a sustainable economy, preserving the environment, and nurturing a socially sustainable structure alongside traditional business objectives (Ateş, 2021a). The adoption of frameworks guiding sustainability efforts, including the Sustainable Development Goals, the UN Framework Convention on Climate Change, and the Paris Agreement, has catalyzed substantial transformations in the business landscape. This has accelerated the implementation of a new socioeconomic model known as environmental, social, and governance (ESG), signaling a shift towards more holistic and responsible business practices (Shih et al., 2023). According to Davis and Blomstrom (1975), CSR, as a managerial obligation, entails a company's efforts to promote, safeguard, and enhance societal welfare while also pursuing its own interests. Carroll (1979) categorizes a company's responsibilities into economic, legal, ethical, and discretionary realms, with CSR encompassing economic, environmental, and social obligations, as per Elkington's (1998) Triple Bottom Line approach. The measurement of companies' CSR initiatives has given rise to the concept of CSP (Ates, 2021a). CSP refers to the outcomes of companies' CSR activities and gauges the degree of active engagement in CSR initiatives (De Bakker et al., 2005; Conway, 2018). Companies that prioritize ESG sustainability activities can enhance firm value by effectively managing risks, proactively addressing regulatory requirements, accessing new markets, and concurrently fostering the sustainable development of the communities where they operate (Dmuchowski et al., 2023). Although companies may face upfront costs for CSR activities in the short term, they stand to reap long-term benefits that can significantly enhance company performance. These benefits include bolstered brand reputation, lowered expenses stemming from improved energy efficiency, competitive advantages, heightened employee productivity, and fortified relations with stakeholders and investors (Haanes et al., 2010).

Sustainability activities serve as guiding principles for businesses, encompassing environmental, social, and economic dimensions. The economic dimension of sustainability delves into the profit-making capacity and long-term viability of businesses. The social dimension underscores the notion that businesses are social entities and should actively address social issues rather than remain indifferent. Meanwhile, the environmental dimension directs businesses in minimizing resource wastage, mitigating environmental degradation, and safeguarding the living standards of future generations (Heybet and Duran, 2023). The concept of sustainable growth was introduced to ascertain and assess whether the growth attained by enterprises through their activities aligns with financial policies (Higgins, 1977). The concept of sustainable growth was first articulated by David Packard, the founder of Hewlett-Packard, in 1950 as the ability of a business to reach its targeted profit level without the need for any additional capital (Van Horne and Wachowicz, 2008). Essentially, the concept of sustainable growth embodies the optimal growth that firms can attain while considering environmental, social, and financial factors as integral components of economic and managerial sustainability.

Sustainable growth, a pivotal component of economic and governance sustainability, entails the optimal utilization of investments and resources to maintain ongoing economic activities. Within competitive market environments, achieving growth targets stands as a primary objective for firms and a key indicator of performance. Sustaining growth necessitates firms' ability to adapt to economic, social, and environmental dynamics. Sustainable growth encompasses value management and the prudent allocation of financial resources to ensure continuity. While effective value and financial management can foster sustainable growth, erroneous value management strategies may precipitate financial distress (Ashraf et al., 2019). Decisions regarding sustainable growth-oriented policies carry significant weight, as missteps in policy formulation can compromise a company's financial performance, particularly in the short term (Modigliani and Pogue, 1974). Consequently, financing growth holds equal importance to achieving and sustaining growth. Although sustainability policies developed within the context of long-term planning may initially curtail firm profitability, they can confer substantial competitive advantages and bolster profitability in the long term (Şamiloğlu and Demirgüneş, 2008).

Sustainable growth is intricately linked to firms' management of resources in their growth endeavors, reflecting their commitment to sustainability. This concept can be quantified through various ratios across different dimensions. For instance, the growth achieved by firms without relying on external financial resources is termed the internal growth rate (IGR) (Amouzesh et al., 2011). On the other hand, the growth achieved by firms with a fixed borrowing rate and internal resources, without capital increment, is known as the sustainable growth rate (SGR) (Higgins, 2012). The evolution in the realm of finance, the proliferation of diverse financial products, and the enhancement of financing opportunities have heightened the significance of borrowing in growth strategies. The sustainable growth model (HSGR), pioneered by Robert C. Higgins in 1977, incorporates variables such as capital increment, autofinancing, and utilization of external resources, enabling a comprehensive analysis of growth dynamics. HSGR serves to compute the SGR and assess the alignment between an enterprise's targeted growth rate for the future and its established financing policy to achieve this target. In this model, inflation is disregarded, the existing depreciation structure is maintained, and it is assumed that businesses seeking to expand their sales will persist if market conditions remain favorable (Higgins, 1977).

Robert C. Higgins (1977) conceptualizes sustainable growth in firms as contingent upon dividend distribution, financing decisions, profitability, and productivity. Discrepancies between HSGR suggested by Higgins (1977) and actual growth rates (AGR) provide valuable insights into firms' growth trajectories and guide financing strategies. Firms with an HSGR below AGR encounter issues of overgrowth, while those with an HSGR surpassing AGR face challenge of slow growth. Overly rapid growth can strain financing capabilities and trigger financial distress costs, whereas slow or stagnant growth may lead to stagnation and an increased risk of financial failure. Consequently, the HSGR serves as a diagnostic tool to identify potential growth constraints in firms and assess the impact of financial performance on growth policies (Şahin and Ergün, 2018). The escalating risk of financial failure stemming from flawed financing policies, low financial performance, and diminished productivity precipitates financial distress, bankruptcy, and liquidation costs, potentially derailing firms from their sustainable growth trajectories.

A high risk of financial failure can erode investor and financial institution confidence in companies, making it challenging for them to access suitable sources of financing and constraining the resources necessary for sustainable growth (Platt et al., 1995). Furthermore, operational constraints such as cash flow challenges, supply chain disruptions, or cost overruns can further impede growth for companies facing a high risk of financial failure. These companies may witness a deterioration in market reputation, declining customer loyalty, and encounter obstacles in penetrating new markets. Consequently, these developments can curtail the market opportunities crucial for sustainable growth. Financially robust companies often can invest more and foster innovation. Conversely, companies with a heightened risk of financial failure may struggle to make such investments, thereby diminishing their ability to sustain long-term growth (Raza et al., 2020). In this context, the risk of financial failure is anticipated to exert a negative impact on companies' SGRs. Implementing measures such as establishing a robust financial footing, adopting effective risk management strategies, and enhancing operational efficiency can assist companies in realizing their sustainable growth objectives (Fonseka et al., 2012; Raza et al., 2020). Therefore, it is important to examine the repercussions of financial failure risk on sustainable growth policies and determine the most suitable financial failure approach for firm managers, investors, and researchers to mitigate these risks and uphold sustainable growth objectives.

This study endeavors to assess the impact of financial failure risk on sustainable growth policies through rigorous econometric analyses. Additionally, it aims to identify financial failure models applicable to the development of sustainable growth policies, catering to the needs of stakeholders such as firm managers, researchers, and investors. Through econometric analyses, the study addresses two pivotal questions: (1) Is financial failure risk a critical consideration in the formulation of sustainable growth policies? This inquiry delves into whether factors such as firms' short-term debt obligations, financial distress costs, bankruptcy risks, capital structure decisions, and working capital management practices significantly influence the sustainability of growth policies. (2) Which financial failure risk model holds the utmost significance for both theorists and practitioners in fostering sustainable growth policies? The response to this question furnishes empirical evidence crucial for firm managers and investors in the process of developing sustainable growth policies. By addressing these questions, the study aims to provide actionable insights that can inform strategic decision-making processes and enhance the resilience and sustainability of firms' growth trajectories. To the best of our knowledge, this study represents the pioneering attempt to explore the implications of financial failure risks on sustainable growth policies in firms. While existing literature extensively investigates the relationships between sustainability performance and firm value, financial performance, and corporate governance factors, and inclusions of firms in sustainability indices (Altınay et al., 2017; Parlakkaya et al., 2019; Geçim, 2020; Sak and Dalgar, 2020; Acar et al., 2021; Korga and Aslanoğlu, 2022; Kulalı, 2022; Atichasari et al., 2023; Günay, 2023; Perdana et al., 2023), the relationship between the risk of financial failure and sustainable growth remains unexplored. This study distinguishes itself significantly from existing literature by elucidating the impact of financial failure risk on sustainable growth policies and identifying the most pertinent financial failure model applicable to the development of sustainable growth policies. By filling this gap in the literature, the study endeavors to enrich the understanding of the intricate dynamics between financial risk management and sustainable growth, offering practical guidance for stakeholders navigating the complexities of contemporary business environments.

The study utilizes data from non-financial firms listed in the XUSRD for the period 2010-2022, with regularly available data. The Sustainability Index serves as a gauge of enterprises' activities across economic, social, and environmental dimensions, as well as their responsiveness to these dimensions. Given that sustainable growth, the focal point of this study, constitutes a component of economic sustainability, the study sample was comprised of XUSRD companies. Sustainable growth policies within firms are evaluated using Higgins's (1977) HSGR, while financial failure risks are assessed through Altman's (1983) Z'-score, Springate's (1978) S-score, Taffler's (1983) T-score, Fulmer et al.'s (1984) H-score, and Legault's (1987) Canada-CA score models. Since increases in the values calculated using the Z'-score, S-score, T-score, H-score, and CA-score models signify a reduction in the risk of financial failure for companies, while decreases indicate an escalation in risk, a positive relationship between these scores and HSGR is anticipated. This study is expected to offer original insights and contribute significantly to the academic literature by identifying the most suitable failure model for assessing the risk of financial failure during the development of sustainable growth policies. Moreover, it aims to uncover the diverse impacts of financial failure models on sustainable growth policies. The study is structured into five main sections. Section 1 outlines the theoretical framework and research questions. Section 2 reviews the relevant academic literature. Section 3 details the data, variables, and methodology employed in the analysis. Section 4 presents the findings, evaluations, and discussions. Finally, Section 5 offers insights, conclusions, and policy recommendations.

2. Literature Review

The rising importance of sustainable development, with its ESG dimensions, compels firms to accord significance to non-financial activities. Sustainable growth objectives, integral to governance sustainability, exhibit substantial correlations with financial activities such as working capital management, capital structure decisions, dividend pay-out decisions, and financial performance. However, the implications of financial activities on long-term sustainability policies, and consequently on sustainable development, often remain overlooked. A review of the relevant literature underscores a notable upsurge in studies scrutinizing the relationship between financial decisions and sustainability in recent years. This section succinctly summarizes recent studies exploring the financial aspect of sustainable growth, the relationship between sustainability performance and financial variables, and the evolution of the concept of sustainable finance along with their key findings based on their respective scopes.

The literature review indicates a scarcity of studies that have explored the financial aspect of sustainable growth. Examining sustainable growth policies in companies, Niu (2016) underscored the necessity of examining the relationship between financial structure and sustainable growth. Within the framework of financial hierarchy theory, Niu (2016) investigated sustainable growth policies in firms utilizing the Higgins (1977) model. Soytaş et al. (2017) delved into the impact of sustainability on the financial performance of Turkish companies. Their research uncovered evidence of a positive relationship between sustainable growth and financial performance. Şahin and Ergün (2018) conducted a study examining the relationship between AGR and SGR differences in financial ratios in publicly traded manufacturing firms. Their objective was to determine the most influential components of SGR. Their findings revealed a negative correlation between the difference of AGR-SGR and return on assets (ROA), as well as return on equity (ROE). Furthermore, they identified profit margin as the most significant component of SGR in influencing this relationship. Raza et al. (2020) investigated the relationship between financial failure risk and sustainable growth by employing the Higgins (1977) SGR models, along with the Altman Z-score financial failure risk model.

Their findings suggest a link between firms' financial failure forecasts and financial sustainability. Yaman and Gür (2023) conducted a study investigating the relationship between financial risks and sustainable growth among BIST firms. They underscored the critical importance of effective risk management in shaping sustainable growth policies. Through regression analyses, they determined that interest rate risk and liquidity risk exert negative effects on Higgins' (1977) HSGR, whereas capital risk has a positive impact. This highlights the nuanced interplay between financial risk factors and sustainable growth strategies within BIST firms. In a more recent study, Gülener et al. (2023) examined the effects of financial management decisions on sustainable growth policies. Their findings revealed that decisions aimed at increasing working capital and dividend payout contribute positively to sustainable growth. Conversely, decisions to increase financial leverage were found to have a negative impact.

Existing literature extensively investigates the relationships between sustainability performance and firm value, financial performance, and corporate governance factors. Ece Çokmutlu and Kılıç (2020) delved into the relationship between sustainability and financial performance by transforming firms' economic, environmental, and social sustainability performances into a singular metric. Their study revealed that while sustainability performance and financial performance do not consistently correlate, they did not find statistical evidence suggesting that sustainability performance is reflected in financial performance. Investigating the relationship between corporate governance and financial sustainability Geçim (2020) observed that the financial sustainability and corporate governance ratings of BIST companies did not align in the same direction during the 2013-2018 periods. Sak and Dalgar (2020), on the other hand, explored the correlation between corporate sustainability practices and financial performance in firms and revealed that corporate sustainability practices exert a statistically significant and positive effect on the financial performance of enterprises. Analyzing the effects of financial and non-financial factors on firms' sustainability performance for BIST firms, Acar et al. (2021) identified several significant determinants. These include board size and independence, audit committee independence, sustainability strategy, and capital structure policies. Acar et al. (2021) notably highlighted a positive relationship between leverage ratio (LEV) and sustainability performance. Emir and Kıymık (2021) delved into the relationship between sustainability levels and financial performance among BIST firms based on Global Reporting Initiative (GRI) principles. Their findings revealed that ROE, ROA, pre-tax profit, and return on capital employed significantly positively affect sustainability performance. Conversely, the growth in assets (GIA) was found to have a significant negative effect. In another study exploring the linkage between financial performance and sustainability performance, Korga and Aslanoğlu (2022) reported that there is no statistically significant relationship between financial performance and sustainability performance. Investigating the relationship between firms' ESG performance and market capitalization, considering the influence of firm size, Kulalı (2022) revealed that all components of ESG exert a significant positive effect on market capitalization, particularly under the influence of firm size. Moreover, Kulalı (2022) noted that the positive impact of ESG factors on market capitalization intensifies as firm size increases. Günay (2023) analyzed the relationship between ESG and financial performance in banks and found that there exists an inverse relationship between ESG performance and financial performance. Günay (2023) suggested that financially successful banks may not prioritize ESG investments, or alternatively, banks focusing on ESG investments may exhibit poorer financial performance. This observation underscores the complexity of balancing ESG considerations with financial outcomes within the banking sector. Investigating the compatibility between firms' sustainability activities and academic studies within the framework of signaling theory, Heybet and Duran (2023) found that sustainability activities are not compatible with academic studies. In another study investigating the relationship between ESG scores and firm performance, Korkmaz and Nur (2023) discovered a significant positive relationship between ESG scores and firm performance in the banking sector. Additionally, they observed that firm age exerts a significant positive moderating effect on this relationship. These findings suggest that higher ESG scores are associated with improved firm performance in the banking sector, and this relationship is strengthened by the age of the firm.

The impact of firms' inclusion in sustainability indices on their financial performance and stock prices has been identified as another significant research topic in the literature. Altınay et al. (2017) explored the implications of Turkish banks' inclusion in the BIST Sustainability Index on their stock values. However, their study did not discern a significant effect arising from this inclusion. In an investigation regarding the impact of firms' inclusion in sustainability indices on their stock values, Parlakkaya et al. (2019) echoed the conclusions drawn by Altınay et al. (2017), indicating that inclusion in sustainability indices did not yield a significant effect on stock returns. Recently, significant studies have been conducted on the advancement of the concepts of sustainable finance and sustainable capital markets, as well as the influence of risk management on sustainability. Sepetis (2020), who defines sustainable capital market theory and holistic sustainable finance models, emphasizes that it is difficult to create a complementary methodology in the field of sustainable finance and that sustainable finance and sustainable capital markets should be surrounded by theories like any new scientific field and draws attention to the importance of developing holistic sustainable finance models. Arpaci (2023) conducted a study to assess the factors predicting financial sustainability in cryptocurrencies. They employed multiple analytical approaches, integrating Artificial Neural Network (ANN) with Structural Equation Modeling (SEM) based on Expectation Confirmation Theory (ECT). Their findings indicated that perceived risk, regulations, volatility, innovativeness, and confirmation of expectations emerge as significant predictors of financial sustainability within the cryptocurrency market. This research sheds light on the multifaceted dynamics influencing the sustainability of cryptocurrencies from various angles, providing valuable insights for stakeholders in the digital currency space. Examining the non-performing loans on corporate financial sustainability Atichasari et al. (2023) obtained findings underscore the importance of proactive risk management, holistic risk assessment, and NPL mitigation strategies in ensuring financial stability and sustainability amid changing economic dynamics. Perdana et al. (2023) investigated the influence of capital and sustainable finance on firm values within banks listed on the ASEAN stock Exchange. Their study revealed a noteworthy impact of capital and sustainable finance on firm value. Moreover, Perdana et al. (2023) noted that institutional ownership played a moderating role in the association between sustainable finance and firm value, although it did not exhibit a similar influence on the connection between capital and firm value. Additionally, institutional ownership was found to affect the relationship between sustainable finance and firm value, as banks aimed to align with international societal expectations or bolster their firm value.

The literature review highlights that the relationships between firms' sustainability performance and SGRs and various intra-firm factors such as firm value, financial performance, and corporate governance have been frequently investigated. However, there is a notable gap in the literature concerning the relationship between the risk of financial failure and sustainable growth. This study is akin to some existing research in terms of its scope and methodology. Nevertheless, it distinguishes itself from the literature by elucidating the effects of financial failure risk on sustainable growth policies. Furthermore, it aims to identify the most suitable financial failure model that can inform the development of sustainable growth policies for stakeholders such as firm managers, researchers, and investors. By addressing this gap, the study not only contributes to the existing body of knowledge but also offers valuable insights into the complex dynamics between financial risk and sustainable growth within firms.

3. Data, Variables and Methodological Design

This study investigates the impact of financial failure risk on sustainable growth policies within firms listed in the BIST Sustainability Index (XUSRD). The dataset encompasses annual financial statement data spanning from 2010 to 2022, focusing on 38 firms listed in XUSRD, for which data are consistently available. Out of the 73 firms listed in the XUSRD, 23 entities such as holdings, banks, insurance companies, etc., are excluded due to disparities in their financial statement structures. An additional 12 firms are omitted because their data couldn't be accessed regularly after the starting date of the study, 2010. Appendix 1 lists the XUSRD firms included in the study, providing transparency regarding the sample composition. The study commences in 2010 to mitigate the potential influence of the 2008 mortgage crisis, ensuring more reliable and unbiased econometric analyses. By 2010, the effects of the crisis had largely subsided in Turkey. It's important to note that the study faces limitations in both time series and cross-sectional dimensions. The dataset is panel data, featuring a cross-sectional dimension (N) of 38 firms and a time dimension (T) of 13 years, resulting in a total of 494 firm/year observations. Given the dataset's multidimensional structure, the relationship between sustainable growth and the risk of financial failure is analyzed using panel regression analysis. This comprehensive approach aims to elucidate the intricate dynamics between financial risk and sustainable growth policies, offering valuable insights for stakeholders navigating the realm of corporate sustainability.

In the panel regression models, the HSGR formulated by Robert C. Higgins in 1977, which is employed in sustainable growth calculations incorporating variable autofinancing and variable borrowing assumptions, is utilized as the dependent variable. The independent variables encompass the Altman (1983) Z'-score, Springate (1978) S-score, Taffler (1983) T-score, Fulmer et al. (1984) H-score, and Legault (1987) CA-score models, which are widely recognized in the financial failure literature for their high predictive success. To enhance the significance levels of the econometric models and minimize inconsistencies and deviations in estimations, several control variables are included. These variables comprise the leverage ratio, ROA, and GIA. Financial data utilized in the calculation of the SGR, financial failure risk, and control variables are sourced from the Financial Information News Network (FINNET) Hisse Expert financial database. The variables incorporated into the econometric models are summarized in Table 1, offering transparency and clarity regarding the analytical framework adopted in the study.

Table 1. Variables

Group	Variable	Acronym	Definition and Calculation
Dependent Variable	Higgins (1977) Sustainable Growth Rate	HSGR	$\frac{p(1-d)(1+L)}{t-p(1-d)(1+L)}$ p = Profit margin after tax, d = Dividend payout ratio L = Total debt/Equity t = Total assets/Net sales
Independent Variables	Altman (1983) Z′ Score	Z′	X_1 = Net working capital/Total assets X_2 = Retained earnings/Total assets X_3 = Earnings before interest and tax (EBIT)/Total assets X_4 = Book value of equity/Book value of total debt X_5 = Sales/Total assets $Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$
	Springate (1978) S Score	S	X_1 = Working capital/ Total assets X_2 = Earnings before interest and tax (EBIT)/Total assets X_3 = Profit before tax/Short-term liabilities X_4 = Sales/Total assets S Skor = $1.03X_1 + 3.07X_2 + 0.66X_3 + 0.4X_4$
	Taffler (1983) T Score	T	X_1 = Earnings before tax/Average short-term liabilities X_2 = Current assets/Total liabilities X_3 = Short-term liabilities/Total assets X_4 = (Current assets–Inventories- Short-term liabilities)/(Net sales-Earnings before tax+Depreciation) $T = 3.20 + 12.18X_1 + 2.5X_2 - 10.68X_3 + 0.03X_4$
	Fulmer et al. (1984) H Score	H	X_1= Retained earnings/Total assets X_2 = Sales/Total assets X_3 = Profit before tax/Equity X_4 = Cash/Total debt X_5 = Total debt/Total assets X_6 = Short-term liabilities/Total assets X_7 = log (Tangible fixed assets) X_8= Working capital/Total debt X_9 = log Earnings before interest and tax (EBIT)/Interest $H = 5.528X_1 + 0.212X_2 + 0.073X_3 + 1.270X_4 - 0.120X_5 + 2.335X_6 + 0.575X_7 + 1.083X_8 + 0.894X_9 - 6.075$
	Legault (1987) Kanada-CA Score	CA	X_1= Shares/Total assets_{t-1} X_2 = Operating profit/Loss+Finance Expense_{t-1}/Total assets_{t-1} X_3 = Sales_{t-2}/Total assets_{t-2} $CA = 4.59X_1 + 4.51X_2 + 0.3936X_3 - 2.76$
Control Variables	Leverage Ratio	LEV	Total debt/Total assets
	Return on Assets	ROA	Net income/Total assets
	Growth in Assets	GIA	Percentage growth in total assets

Source: Higgins (1977), Springate (1978), Altman (1983), Taffler (1983), Fulmer et al. (1984), Legault (1987).

The control variables incorporated in the models are selected based on their presumed impact on firms' SGRs. Each variable undergoes standardization through percentage transformation, enabling the elucidation of the change in the dependent variable resulting from a 1-unit change in both the independent and control variables. A total of 6 panel data models are constructed to explore the relationship between sustainable growth policies and the financial failure risk. In each model, the HSGR serves as the dependent variable, while the Altman (Z'), Springate (S), Taffler (T), Fulmer et al. (H), and Legault (CA) scores are included as independent variables, separately assessing the impact of each financial failure model on sustainable growth. Additionally, a single model is devised wherein all financial failure risk scores are integrated as independent variables. This enables an examination of the collective explanatory power of financial failure models in elucidating changes in sustainable growth. The analysis is conducted using EViews 12 and Gauss 22 econometric analysis package programs.

The panel data analyses in this study encompass both time series and cross-sectional series, requiring adherence to the assumptions of both types of analyses. To ensure robustness and accuracy, a comprehensive five-stage methodological approach, including assumption tests, is adopted. In the first stage, the potential for multicollinearity among the independent and control variables is examined. Spearman correlation analysis and Variance Inflation Factor (VIF) analysis are utilized for this purpose. The second stage involves testing for horizontal cross-section dependence and coefficient homogeneity. The Pesaran (2004) CD test assesses horizontal cross-section dependence, while the Pesaran and Yamagata (2008) delta test evaluates coefficient homogeneity ($\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$). In the third stage of the analysis, the stationarity of the series is evaluated using panel unit root tests. This involves applying the Levin, Lin, and Chu (2002) LLC test, which is a first-generation unit root test, and the Pesaran (2007) CIPS test, a second-generation unit root test. These tests are conducted on the series at both the level and first difference. The LLC test and CIPS test are essential tools for assessing the stationarity of panel data, helping to determine whether the variables exhibit unit roots, indicating non-stationarity, or are stationary. The choice of LLC and CIPS tests is based on the results of the CD and, $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests used in the earlier stages of the analysis. The fourth stage involves diagnostic tests to identify potential issues such as autocorrelation and heteroscedasticity in the models. Baltagi and Li (1991) LM_p and Born and Breitung (2016) LM_p^* tests are emploted for testing the autocorrelation, and Breusch and Pagan (1979) LM_h test is employed for testing the heteroscedasticity problems. For models exhibiting autocorrelation and/or heteroscedasticity issues, estimations are conducted using the Period SUR robust estimator based on Period Corrected Standard Errors (PCSE) developed by Beck and Katz (1995). Finally, in the fifth and final stage, panel regression models are estimated according to equations 1-6, allowing for a comprehensive analysis of the relationships between the variables under investigation. This rigorous methodological approach ensures the validity and reliability of the panel regression analyses, enabling robust insights into the complex dynamics of sustainable growth policies and financial risk factors in firms.

Model 1 $$HSGR_{it} = \beta_0 + \beta_1 Z'_{it} + \beta_2 LEV_{it} + \beta_3 ROA_{it} + \beta_4 GIA_{it} + u_{it} \quad (1)$$

Model 2 $$HSGR_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 LEV_{it} + \beta_3 ROA_{it} + \beta_4 GIA_{it} + u_{it} \quad (2)$$

Model 3 $$HSGR_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 LEV_{it} + \beta_3 ROA_{it} + \beta_4 GIA_{it} + u_{it} \quad (3)$$

Model 4 $$HSGR_{it} = \beta_0 + \beta_1 H_{it} + \beta_2 LEV_{it} + \beta_3 ROA_{it} + \beta_4 GIA_{it} + u_{it} \quad (4)$$

Model 5 $$HSGR_{it} = \beta_0 + \beta_1 CA_{it} + \beta_2 LEV_{it} + \beta_3 ROA_{it} + \beta_4 GIA_{it} + u_{it} \quad (5)$$

Model 6 $$HSGR_{it} = \beta_0 + \beta_1 Z'_{it} + \beta_2 S_{it} + \beta_3 T_{it} + \beta_4 H_{it} + \beta_5 CA_{it} + \beta_6 LEV_{it} + \beta_7 ROA_{it} + \beta_8 GIA_{it} + u_{it} \quad (6)$$

For each specified panel regression model in Equations 1-5, the relationship between financial failure risk and sustainable growth policies is examined through a different financial failure risk measurement method. Additionally, Model 6 assesses the combined explanatory power of financial failure models regarding changes in sustainable growth policies. The alternative hypotheses tested for the models are outlined as follows:

H_1: Z' score positively affects sustainable growth policies.

H_2: S score positively affects sustainable growth policies.

H_3: T score positively affects sustainable growth policies.

H_4: H score positively affects sustainable growth policies.

H_5: CA score positively affects sustainable growth policies.

H_6: Financial failure scores affect sustainable growth policies.

In Equation 1-6, β_0 is the constant, β_n (n: 1, …, N) is the slope coefficient of the independent variable, u_{it} is the error term, t is time dimension (years), where t: 1, …, T, and i denotes cross-sections (firms).

4. Findings and Discussion

Before proceeding to the empirical findings regarding the relationship between sustainable growth and financial failure risk, the characteristics of the variables are explored through descriptive statistics and normality analysis. Additionally, the linear link between sustainable growth policies and financial failure risk scores is examined and visualized via scatter diagrams and regression lines. Descriptive statistics and Jarque-Bera (J-B) normality analysis results for the variables are presented in Table 2, while the scatter diagrams and regression lines between HSGR and financial failure scores are presented in Figure 1.

Table 2. Descriptive Statistics and the Test of Normality

	Variables				
	HSGR	**Z'**	**S**	**T**	**H**
Mean	0.003018	0.024617	0.017768	-0.1227	0,06782
Median	-0.07763	-0.00825	-0.00411	-0.04864	0,034246
Max.	19.09121	2.525555	13.16348	13.31661	7,782628
Min.	-23.0837	-0.70407	-6.49732	-47.8031	-0,61786
Std. Dev.	2.648527	0.257994	0.918197	3.12068	0,415061
Skewness	-1.05358	3.331636	4.736187	-7.98543	13,16032
Kurtosis	30.15121	27.42526	98.97347	121.4239	243,1826
J-B	15265.18***	13193.76***	191438***	293915.3***	1201665***
	CA	**LEV**	**ROA**	**GIA**	
Mean	-0.42627	0.025294	-0.08373	0.271864	
Median	-0.00502	0.015608	-0.04611	0.205862	
Max.	10.28211	0.966838	55.96938	1.709319	
Min.	-121.905	-0.36269	-72.5847	-0.21246	
Std. Dev.	5.763895	0.12959	5.120187	0.271782	
Skewness	-19.1532	1.593132	-1.81025	1.807532	
Kurtosis	401.5331	11.30856	126.8705	7.225342	
J-B	3299426***	1629.881***	316098.4***	636.4821***	

Note: *** indicates 1% significance level.

Descriptive statistics show that the Fulmer et al. (1984) H-score has the highest mean value with 0.06 among the financial failure scores, the mean value of the dependent variable HSGR is 0.003, and GIA has the highest mean value of 0.27 overall. ROA demonstrates the widest range of values, with the highest maximum value recorded at 55.96 and the lowest minimum value at -72.58. Additionally, ROA also displays the highest standard deviation, measured at 5.12. When interpreting the descriptive statistics, it is crucial to consider that the variables included in the model are based on percentage change values rather than raw values. The analysis reveals that HSGR, T-score, CA-score, and ROA exhibit left skewness, whereas the other variables demonstrate right skewness. Furthermore, all variables display leptokurtic distributions. The J-B statistics and associated probability values indicate that none of the variables are normally distributed at the 1% significance level. Specifically, the discrepancy between mean and median values, along with kurtosis and skewness values deviating from 0, further corroborates the non-normal distribution of all variables. This information underscores the importance of understanding the distributional characteristics of the variables, which can significantly influence the statistical analysis and interpretation of results in the model. Scatter diagrams and regression lines offer a clear depiction of the potential linear association between sustainable growth policies and financial failure risk scores, aiding in the initial exploration of the relationship. The scatter diagrams and regression lines reveal a positive association between sustainable growth and financial failure scores. Specifically, the regression lines between HSGR and Altman Z' (1983), Taffler (1983) T, and Fulmer et al. H (1984) exhibit a positive slope. This suggests that enhancements in firms' financial stability, characterized by a reduction in the risk of financial failure, positively influence the sustainability of growth policies. Conversely, the regression lines between HSGR and Springate (1978) S, as well as Legault (1987) CA, appear flat, indicating an insignificant relationship between these variables. This observation suggests that variations in S and CA scores do not significantly impact sustainable growth policies.

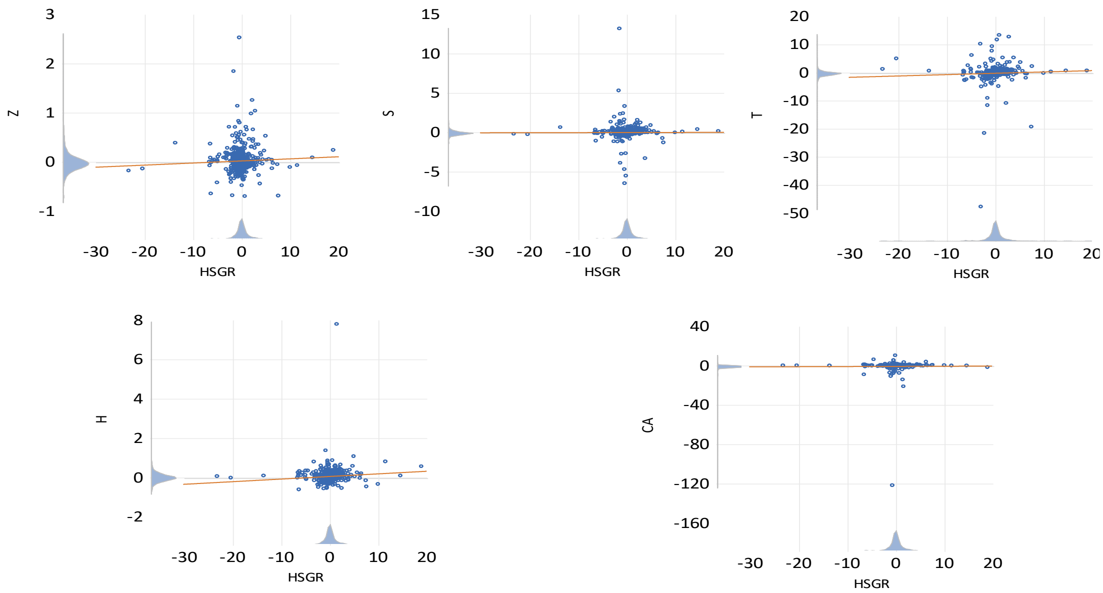

Figure 1. Scatter Diagram and Regression Line Between HSGR and Financial Failure Scores

Multi-collinearity was assessed through Spearman correlation and VIF analyses. With ρ representing the correlation coefficient, the pairs of independent variables with ρ>0.75 and ρ<-0.75 were considered to indicate multi-collinearity if included in the same model Furthermore, a threshold value of 4 was accepted for the VIF analysis. It was acknowledged that variables with a VIF value greater than 4 when included together as independent variables in the panel regression model, could contribute to multi-collinearity problems. The Spearman correlation matrix and VIF analysis results are presented in Table 3. According to the Spearman correlation analysis, it is found that the explanatory variable pair with the highest ρ value is Z' and H (ρ=0.21), while the pair with the lowest ρ value is Z' and LEV (ρ=−0.40). Regarding the VIF analysis, it is found that the variable with the highest VIF value is Z' (1.26), and the one with the lowest VIF value is CA (1.00). The Spearman correlation analysis results indicated that none of the explanatory variable pairs met the conditions ρ>0.75 and ρ<−0.75. Similarly, the VIF analysis results showed that none of the explanatory variables met the condition VIF>4. In light of these findings, it is assumed that the explanatory variables included in the models would not cause deviations stemming from multi-collinearity.

Table 3. Spearman Correlation Matrix and VIF Analysis Results

Variables	Z'	S	T	H	CA	LEV	ROA	GIA
Z'	1.00000 ---							
S	0.133119 (0.003)***	1.00000 ---						
T	-0.04101 (0.363)	-0.02544 (0.5727)	1.00000 ---					
H	0.219186 (0.0000)***	0.019636 (0.6633)	0.055291 (0.2199)	1.00000 ---				
CA	0.017119 (0.7043)	-0.00035 (0.9937)	-0.00039 (0.9931)	0.011764 (0.7942)	1.00000 ---			
LEV	-0.40936 (0.0000)***	-0.10605 (0.0184)*	-0.07055 (0.1174)	-0.13149 (0.0034)**	-0.00521 (0.9081)	1.00000 ---		
ROA	0.039225 (0.3843)	0.002881 (0.9491)	0.047127 (0.2958)	0.046127 (0.3062)	-0.00505 (0.9109)	-0.12322 (0.0061)***	1.00000 ---	
GIA	-0.04617 (0.3058)	0.012712 (0.7781)	0.010395 (0.8177)	0.03946 (0.3815)	-0.05552 (0.218)	0.12301 (0.0062)**	0.034352 (0.4462)	1.00000 ---
Variables	**Z'**	**S**	**T**	**H**	**CA**	**LEV**	**ROA**	**GIA**
R^2	0.20934	0.022476	0.016733	0.057707	0.003506	0.202419	0.020054	0.024602
VIF	1.264766	1.022993	1.017018	1.061241	1.003518	1.253791	1.020464	1.025223

Note: Signs ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.

Testing for cross-sectional dependency and slope homogeneity in coefficients is essential for understanding the characteristics of the dataset and selecting the correct stationarity test (De Hoyos and Safaridis, 2016). Given that the dataset of the study exhibits N>T, cross-sectional dependence on a variable basis is assessed using the Pesaran (2004) CD test, while the homogeneity of slope coefficients is examined using the Pesaran and Yamagata (2008) $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests. The results of the CD, $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests are presented in Table 4. The CD test outcomes reveal that all variables, except for S and T variables, exhibit horizontal cross-section dependence at the 1% significance level. On the other hand, $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests demonstrate reveal that the slope coefficients are homogeneous across all variables, except for CA.

Table 4. Cross-section Dependence and Slope Homogeneity Test Results

Variables	CD	$\tilde{\Delta}$	$\tilde{\Delta}_{adj}$
HSGR	2.708185***	-0.129	-0.147
Z'	9.984605***	0.158	0.18
S	0.837574	0.932	1.062
T	0.70536	-1.772	-2.02
H	30.66571***	-0.028	-0.032
CA	6.29914***	2.654***	3.026***
LEV	4.125579***	-0.827	-0.943
ROA	3.227562***	0.017	0.020
GIA	45.04331***	0.446	0.509
Null Hypothesis for CD Test	H_0: No cross-sectional dependency.		
Null Hypothesis for $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ Test	H_0: No heterogeneity in slope coefficients.		

Note: *** indicates 1% significance level.

Following the results of the CD test and $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests, the HSGR, Z', H, CA, LEV, ROA, and GIA undergo stationarity testing using the Pesaran (2007) CIPS test, a second-generation unit root test. Meanwhile, the S and T variables undergo stationarity testing with the Levin, Lin, and Chu (2002) LLC unit root test, a first-generation unit root test. The outcomes of the unit root tests are displayed in Table 5. Results of the LLC and CIPS panel unit root tests indicate that all variables do not contain unit roots at the 1% significance level in both intercept and intercept-trend models. Based on the first and second-generation unit root tests, all dependent, explanatory, and control variables are stationary at the level. This outcome suggests that all variables demonstrate a tendency to revert to the mean in the long-run and can be integrated into panel regression models in their current form.

Table 5. Unit Root Test Results

First-Generation Unit Root Test		Levin, Lin and Chu (2002) LLC				
Model		Intercept		Intercept and Trend		Decision
Variables		Statistic	Probability	Statistic	Probability	
S		-16.9406***	0.00000	-14.5019***	0.00000	I(0)
T		-19.0694***	0.00000	-15.1429***	0.00000	I(0)
Second-Generation Unit Root Test		**Pesaran (2007) CIPS**				
Model		Intercept		Intercept and Trend		Decision
Variables		CIPS	Truncated CIPS	CIPS	Truncated CIPS	
HSGR		-0.272217***	-2.72217***	-3.38826***	-3.04228***	I(0)
Z'		-3.33808***	-3.22647***	-3.29116***	-3.18283***	I(0)
H		-3.41318***	-3.34564***	-3.40962***	-3.36131***	I(0)
CA		-3.30448***	-3.38994***	-4.38825***	-4.10144***	I(0)
LEV		-3.18587***	-3.18587***	-3.09864***	-3.08733***	I(0)
ROA		-5.14024***	-3.43824***	-5.64579***	-3.98295***	I(0)
GIA		-3.22650***	-3.16767***	-3.33236***	-3.29125***	I(0)
Critical Values	1%	-2.41	-2.37	-3.09	-2.98	
	5%	-2.19	-2.18	-2.82	-2.74	
	10%	-2.08	-2.07	-2.68	-2.62	
Null Hypothesis for LLC and CIPS Tests		H_0: No stationary.				

Note: Lag lengths are determined according to the Schwarz Information Criterion.
*** indicates 1% significance level. The decision I(0) implies stationarity at the level.

Before conducting panel regression analysis, it is imperative to test two critical assumptions: autocorrelation, which evaluates significant relationships between successive error terms, and heteroskedasticity, which assesses differences in error term variances across cross-sections or the presence of non-zero error term covariances.

Autocorrelation testing in this study relies on the Baltagi and Li (1991) LM_p test and Born and Breitung (2016) LM_p^* test, an improved version of LM_p test. Hetetoskedasticity testing, on the other hand, relies on the Breusch and Pagan (1979) LM_h test. Furthermore, the F, Breusch and Pagan (1980) LM, and Honda (1985) tests are employed for estimator specification. The F test examines the variations in the fixed parameter, and the Breusch and Pagan (1980) LM and Honda (1985) tests determine the presence of random effects in the model. The diagnostic tests and estimator specification test results are presented in Table 6.

Table 6. Diagnostic and Estimator Specification Tests Results

Tests		**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Baltagi and Li (1991) LM_p		2.736654*	2.81625*	2.938835*	2.611733	2.819041*	2.572022
Born and Breitung (2016)		12.02761**	12.19553**	12.45175**	11.76151**	12.20139**	11.67623**
Breusch and Pagan (1979)		477.3533**	479.0106**	480.0232**	480.302***	478.965***	482.7967**
Tests	**Models**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
F Test	Group FE	1.414212*	1.410463*	1.386941*	1.391508*	1.406844*	1.370535*
	Time FE	1.763629*	1.744525*	1.769796*	1.695502*	1.734768*	1.730089*
	Two-way FE	1.502008**	1.505492**	1.499247**	1.473799**	1.501015**	1.466442**
Breusch and Pagan(198	Group RE	2.059179	2.17284	1.94128	1.92116	2.174781	1.707256
	Time RE	1.257367	1.607381	1.825417	1.340532	1.51215	1.229612
	Two-way RE	3.316545	3.780221	3.766697	3.261692	3.686931	2.936868
Honda (1985) Test	Group RE	1.434984*	1.474056*	1.393298*	1.386059*	1.474714*	1.30662*
	Time RE	1.121324	1.267825	1.35108*	1.157813	1.229695	1.108879
	Two-way RE	1.807582	1.938803**	1.940568**	1.79879**	1.912306**	1.708015**
Null hypothesis	LM_p and LM_p^*	H_0: No serial correlation.					
	LM_h	H_0: No heteroskedasticity.					
	Group FE/RE	H_0: While there is a cross-section effect, there is no time effect.					
	Time FE/RE	H_0: While there is a time effect, there is no cross-section effect.					
	Two-way	H_0: No cross-section or time effect.					

Note: Signs ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

The Baltagi and Li (1991) LM_p test results reject the null hypothesis at the 10% significance level in Models 1, 2, 3, and 5. On the other hand, the Born and Breitung (2016) LM_p^* test results reject the null hypothesis at the 1% significance level in all models. These results indicate the presence of an autocorrelation problem in all models. The Breusch and Pagan (1979) LM_h test results reject the null hypothesis at the 1% significance level in all models, suggesting the presence of a heteroskedasticity problem in all models. In order to avoid the inconsistent and biased results stemming from autocorrelation and heteroscedasticity issues, estimations are conducted using the Period SUR (PCSE) robust estimator, developed by Beck and Katz (1995). The F test results reveal that the probability values for the group fixed effects and time fixed effects are greater than 0.05 across all models, indicating the absence of cross-sectional or time fixed effects in the models. Similarly, the LM and Honda test results indicate the absence of random effects in both the cross-sectional and time dimensions. Baltagi (2014) proposes a fixed effects model when the data set focuses on a specific group of firms, countries, or individuals, and the findings are confined to the behavior of these groups. Consequently, the F test findings guide the selection of the estimator specification. Thus, the pool model is employed in the panel regression analyses. Finally, the estimation outcomes of the panel regression models designed to ascertain the relationship between sustainable growth policies and the financial failure risk are presented in Table 7.

Tablo 7. Panel Regression Results

Ind. Variables		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Z'	Coef.	0.405411					0,176995
	t-Stat.	1.093774					0,452089
S	Coef.		0.008427				0,012169
	t-Stat.		0.129828				0,187664
T	Coef.			0.489732			0,505101
	t-Stat.			2.918285***			3,130656***
H	Coef.				0.562578		0,541900
	t-Stat.				2.827543***		2,62401***
CA	Coef.					0.012188	0,012556
	t-Stat.					0.46807	0,478714
LEV	Coef.	-0.869531	-1.18051	-1.24447	-0.829774	-1.189513	-0,733613
	t-Stat.	-1.553253	-2.398381**	-2.61966***	-1.64547	-2.423209**	-1,334958
ROA	Coef.	0.042283	0.042582	0.039076	0.041542	0.042374	0,037948
	t-Stat.	2.652943***	2.654382***	2.46711**	2.597598***	2.637625***	2,404837**
GIA	Coef.	0.697715	0.679034	0.648254	0.644042	0.692704	0,606719
	t-Stat.	2.098192**	2.059805**	2.046729**	1.961122**	2.102396**	1,896194*
C	Coef.	-0.120283	-0.102526	-0.09768	-0.141495	-0.102162	-0,144934
	t-Stat.	-1.015774	-0.882039	-0.86777	-1.200024	-0.87889	-1,258729
R^2		0,378190	0.362754	0.539938	0.528276	0.366653	0.730781
Adjusted R^2		0,299480	0.283922	0.462553	0.450794	0.287859	0.657883
F-Statistic		4,805055***	4.601533***	6.977387***	6.81824***	4.652863***	4.779631***
Prob(F-Statistic)		0,000826	0.001177	0.000018	0.000024	0.001077	0.00001
D-W Stat.		1,983449	1.986811	1.989785	1.983695	1.98539	1.994833

Note: Signs ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.
In all models, the F-test results were considered in the estimator specification, and the analyses were conducted using the pooled model approach.

The results of the panel regression analysis reveal that all models exhibit F-probability values below 0.01, signifying statistical significance at the 1% level. This suggests that financial failure scores, along with control variables, collectively elucidate the variations in sustainable growth policies in a statistically significant manner. The significant F-probability values across the models enable the testing of alternative hypotheses regarding the impact of financial failure scores on sustainable growth policies. Among the models, Model 3 stands out with the lowest F-probability value (0.000018), alongside the highest F-statistic (6.977387) and R^2 (0.539938). According to the findings, the combination of Z'-score and control variables in Model 1 accounts for 38% of the changes in sustainable growth policies, while this explanatory capability extends to 36% for Model 2, 54% for Model 3, 53% for Model 4, and 37% for Model 5. In Model 6, where all financial failure scores are incorporated as independent variables, a substantial 73% of the changes in sustainable growth policies are explained collectively in a statistically significant manner. The D-W stat. (Durbin-Watson statistic) values for the models closely approximate 2, suggesting that the robust estimators effectively eliminated the autocorrelation issue.

Models 1-5 demonstrate that all financial failure risk indicators have positive effects on sustainable growth policies as suggested by Platt et al., (1995), Fonseka et al. (2012) and Raza et al. (2020). However, these effects are not statistically significant across all financial failure risk models. Specifically, the results from Models 1, 2, and 5 indicate that the Altman (1983) Z'-score, Springate (1978) S-score, and Legault (1987) CA-score financial failure risk indicators fail to significantly explain the changes in sustainable growth policies of BIST Sustainability Index companies. Consequently, the alternative hypotheses H_1, H_2 and H_5 are rejected based on the findings. The outcomes from Models 1, 2, and 5 suggest that factors such as difficulties in short-term debt repayments, costs of financial distress, bankruptcy costs, capital structure decisions, working capital management decisions, and financial failure risks may not be pivotal factors influencing firms' sustainable growth policies. This finding not only diverges from traditional finance theory and is inconsistent with the findings of Platt et al., (1995), Fonseka et al. (2012) and Raza et al. (2020) but also seems unrealistic. Consequently, it can be inferred that the information and insights provided by the Altman (1983) Z'-score, Springate (1978) S-score, and Legault (1987) CA-score financial failure models may not offer valuable insights for both theorists and practitioners in understanding the relationship between firms' sustainable growth policies and financial performance. On the contrary, the outcomes from Models 3-4 highlight that the Taffler (1983) T-score and Fulmer et al. (1984) H-score financial failure risk indicators strongly explain the changes in sustainable growth policies at the 1% significance level. Consequently, the alternative hypotheses H_3 and H_4 cannot be rejected. Aligned with traditional finance theory, the results from Models 3-4 suggest that financial management decisions, financial success, and financial performance play crucial roles in the sustainability of growth policies. This finding is significantly consistent with the findings of the Platt et al., (1995), Fonseka et al. (2012) Raza et al. (2020), Niu (2016), Soytaş et al. (2017), Yaman and Gür (2023), Gülener et al. (2023). In this context, Taffler's (1983) T-score and Fulmer et al.'s (1984) H-score financial failure models offer valuable insights into understanding the connections between firms' sustainable growth policies and their financial performance. Assessing the impacts of the T-score and H-score financial failure risk indicators on the HSGR reveals that a 1-unit change in the T-score corresponds to a 0.49-unit change in the HSGR, while a 1-unit change in the H-score results in a 0.56-unit change in the HSGR. Although the Fulmer et al. (1984) H-score model may appear to be a more practical indicator for formulating sustainable growth policies in firms, the t-statistics values for the T and H score variables (2.9.8285 and 2.827573, respectively) indicate that Taffler's (1983) T-score model holds more significant potential for assisting firm managers in developing sustainable growth policies. Additionally, the superior performance of Model 3, which incorporates the T-score financial failure risk factor, is evidenced by its higher F-statistic and R^2 values compared to Model 4. Furthermore, the statistical significance of all control variables' t-statistics in Model 3, as opposed to the financial leverage variable's lack of statistical significance in Model 4, further reinforces the superiority of Model 3.

Model 6 is a statistically significant model due to its high F-statistic. Consequently, the alternative hypothesis H_6 cannot be rejected. The outcomes of Model 6 are fully consistent with the findings observed in Models 1-5. Specifically, Model 6 reveals that the impacts of Z', S, and CA financial failure risk scores on sustainable growth policies lack statistical significance, while the effects of T and H financial failure risk scores are statistically significant. Furthermore, in Model 6, the T-score variable exhibits a higher t-statistic compared to the H-score variable. This observation aligns with the results from Models 3-4, underscoring the importance of scrutinizing Taffler's (1983) T-score model in the context of developing sustainable growth policies.

5. Conclusions and Recommendations

Sustainable growth relies on the effective generation and allocation of internal resources, as well as the efficient utilization of external resources. A sustainable environment requires a sustainable economic and financial system, at a macro-scale. A sustainable economic system, on the other hand, requires a high level of endogenous resource creation capabilities of micro units that are compatible with environmental conditions and social standards. Ultimately, the sustainable growth performance of economic entities is an important component of environmental, social, and governance sustainability. Examining the determinants of sustainable growth performance offers valuable insights for stakeholders such as corporate managers and investors at the micro level, as well as policymakers shaping economic and environmental strategies at the macro level. This study aims to provide information to macro and micro beneficiaries in developing sustainability policies and to contribute to the sustainable growth literature by examining the effects of financial failure risk on firms' sustainable growth policies. The research encompasses non-financial entities listed in the BIST Sustainability Index, with accessible data spanning from 2010 to 2022. In calculating firms' SGRs, the study employs the HSGR ratio as proposed by Higgins (1977), while assessing the risk of financial failure through the Altman (1983) Z'-score, Springate (1978) S-score, Taffler (1983) T-score, Fulmer et al. (1984) H-score, and Legault (1987) CA-score models. The analysis follows a five-stage panel data methodology, including the pre-tests of multi-collinearity, cross-sectional dependency, slope homogeneity, stationarity, autocorrelation and heteroskedasticity, and panel regression analysis.

The panel regression analysis reveals the significance of all developed models. In particular, the statistical significance of the model in which all financial failure scores are included together as independent variables answers the first research question positively. This affirmative response to the initial research question suggests a positive impact of financial failure scores on the SGR of BIST Sustainability Index firms, as suggested by Platt et al., (1995), Fonseka et al. (2012) and Raza et al. (2020). However, not all financial failure models yield significant results. Specifically, the analysis indicates that financial failure scores derived from the Altman (1983) Z'-score, Springate (1978) S-score, and Legault (1987) CA-score models do not significantly influence firms' sustainable growth policies. This implies that factors such as short-term debt repayment challenges, financial distress expenses, bankruptcy outlays, capital structure decisions, and working capital management decisions may not substantially shape firms' sustainable growth strategies. Conversely, the statistically significant relationships observed between Taffler (1983) T-score and Fulmer et al. (1984) H-score financial failure scores and SGRs highlight the pivotal role of financing decisions in shaping growth strategies and fostering sustainable growth. Thus, it is suggested that Taffler's (1983) T-score and Fulmer et al. (1984) H-score financial failure models be prioritized over Altman (1983) Z'-score, Springate (1978) S-score, and Legault (1987) CA-score models in the process of developing sustainable growth policies for firms.

The comparison of the explanatory power between the Taffler (1983) T-score and Fulmer et al. (1984) H-score financial failure models underscore the superiority of the T-score, directly addressing the second research question. The findings strongly suggest that the Taffler (1983) T-score model stands out as the most beneficial financial failure model for scrutinizing the risk of financial failure in the development of sustainable growth policies. Examining the components and coefficients of the Taffler (1983) T-score model reveals that enhancements in pre-tax profits, a flexible working capital investment policy, a balanced working capital financing policy, and a high net working capital level significantly contribute to the sustainability of growth policies. These results underscore the significance of short-term investment and financing decisions alongside long-term financial strategies for sustainable growth. The examination of the components and coefficients of the Fulmer et al. (1984) H-score model elucidates the positive impact of autofinancing policy and working capital investments on attaining sustainable growth, and negative impact of high debt financing. The findings generally suggest that companies at a high risk of financial failure may encounter operational constraints, such as cash flow issues, supply chain disruptions, or rising costs, which may limit their growth and steer them away from sustainability goals. The analysis reveals that balanced financing policy and flexible investment policy in working capital management, along with autofinancing decisions, positively contribute to sustainable growth, whereas high debt levels have adverse effects. Remarkably, these findings align significantly with previous studies by Platt et al., (1995), Fonseka et al. (2012), Raza et al. (2020), Niu (2016), Soytaş et al. (2017), Yaman and Gür (2023), and Gülener et al. (2023). Consistent with the analysis findings, it can be inferred that establishing a solid financial footing, implementing effective risk management strategies, and enhancing operational efficiency are crucial steps for BIST Sustainability Index companies to attain their sustainable growth objectives.

The findings of the study are believed to provide valuable insights to firm managers and investors at the micro level, and to environmental and economic policymakers at the macro level and contribute to the existing literature, and provide valuable resources for theoreticians. However, it's essential to handle the cross-sectional and time dimension constraints of the study carefully while evaluating the findings. Since the study covers non-financial firms, a similar evaluation of the findings for financial sector firms may lead to inaccurate results. Furthermore, the exclusion of factors other than the risk of financial failure that could influence sustainable growth policies represents a significant limitation of the study. In future research, incorporating factors such as dividend policy, internal capital market variables, agency costs, and macroeconomic indicators as determinants of sustainable growth policies alongside financial failure risk may provide valuable insights across various segments and further enrich the literature in this field.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest
There is no potential conflicts of interest in this study.

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Appendix 1.

BIST Sustainability Index Firms Included in the Study

No	Code	Firm Title	No	Code	Firm Title
1	AKCNS	Akçansa Çimento Sanayi ve Ticaret A.Ş.	20	KORDS	Kordsa Teknik Tekstil A.Ş.
2	AKENR	Akenerji Elektrik Üretim A.Ş.	21	LOGO	Logo Yazılım Sanayi ve Ticaret A.Ş.
3	AKSA	Aksa Akrilik Kimya Sanayi A.Ş.	22	MGROS	Migros Ticaret A.Ş.
4	AKSEN	Aksa Enerji Üretim A.Ş.	23	NETAS	Netaş Telekomünikasyon A.Ş.
5	AEFES	Anadolu Efes Biracılık ve Malt Sanayi A.Ş.	24	OTKAR	Otokar Otomotiv ve Savunma Sanayi A.Ş.
6	ARCLK	Arçelik A.Ş.	25	PNSUT	Pınar Süt Mamulleri Sanayi A.Ş.
7	ASELS	Aselsan Elektronik Sanayi ve Ticaret A.Ş.	26	SISE	Türkiye Şişe ve Cam Fabrikaları A.Ş.
8	AYGAZ	Aygaz A.Ş.	27	TATGD	Tat Gıda Sanayi A.Ş.
9	BIMAS	BİM Birleşik Mağazalar A.Ş.	28	TAVHL	Tav Havalimanları Holding A.Ş.
10	BIZIM	Bizim Toptan Satış Mağazaları A.Ş.	29	TOASO	Tofaş Türk Otomobil Fabrikası A.Ş.
11	BRISA	Brisa Brıdgestone Sabancı Lastik Sanayi ve Ticaret A.Ş.	30	TUPRS	Tüpraş-Türkiye Petrol Rafinerileri A.Ş.
12	CIMSA	Çimsa Çimento Sanayi ve Ticaret A.Ş.	31	THYAO	Türk Hava Yolları A.O.
13	CCOLA	Coca-Cola İçecek A.Ş.	32	TTKOM	Türk Telekomünikasyon A.Ş.
14	DOCO	Do & Co Aktıengesellschaft	33	TTRAK	Türk Traktör ve Ziraat Makineleri A.Ş.
15	DOAS	Doğuş Otomotiv Servis ve Ticaret A.Ş.	34	TCELL	Turkcell İletişim Hizmetleri A.Ş.
16	ENKAI	Enka İnşaat ve Sanayi A.Ş.	35	ULKER	Ülker Bisküvi Sanayi A.Ş.
17	EREGL	Ereğli Demir ve Çelik Fabrikaları T.A.Ş.	36	VESTL	Vestel Elektronik Sanayi ve Ticaret A.Ş.
18	FROTO	Ford Otomotiv Sanayi A.Ş.	37	VESBE	Vestel Beyaz Eşya Sanayi ve Ticaret A.Ş.
19	KARSN	Karsan Otomotiv Sanayi ve Ticaret A.Ş.	38	ZOREN	Zorlu Enerji Elektrik Üretim A.Ş.