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DEVIATION FROM SUSTAINABLE GROWTH AND BANKRUPTCY RISK IN BUSINESSES

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Abstract

The failure of businesses to achieve sustainable growth, excessive or insufficient growth can pose serious risks to the financial health of businesses. The relationship between excessive growth (positive difference between AGR and SGR) and bankruptcy risk is considered important in terms of management strategies and investment decisions of businesses. This study aims to reveal whether the growth of businesses above their sustainable growth rates increases their financial risk levels and therefore whether it can be associated with bankruptcy risk. In the study, the annual data of 50 businesses, excluding financial sector and holdings traded on Borsa Istanbul, between the years 2017-2023 were analyzed using the Panel EGLS method. According to the analysis results, a negative relationship was found between excessive growth and bankruptcy risk. This finding shows that the Altman Z-Score decreases in the event of increased excessive growth, i.e., the risk of bankruptcy increases. Rapid growth in businesses can lead to deterioration of the financial structure, liquidity problems and ultimately an increase in bankruptcy risk due to the high capital requirements and increased borrowing. Therefore, it is critical for businesses to consider sustainable growth rates when managing their growth rates.

Keywords: Financial Risk Management, Sustainable growth, Excessive growth, Bankruptcy risk, Altman Z
JEL Classification: G23, G33, M21

İŞLETMELERDE SÜRDÜRÜLEBİLİR BÜYÜMEDEN SAPMA VE İFLAS RİSKİ

Öz

İşletmelerde büyümenin sürdürülebilir bir seviyede gerçekleşmemesi, aşırı veya yetersiz büyüme durumları, işletmelerin finansal sağlıkları üzerinde ciddi riskler doğurabilir. Aşırı büyüme (AGR - SGR pozitif farkı) ve iflas riski arasındaki ilişki, işletmelerin yönetim stratejileri ve yatırım kararları açısından önemli olduğu düşünülür. Bu çalışma, işletmelerin sürdürülebilir büyüme oranlarının üzerinde bir büyüme gerçekleştirmelerinin, onların finansal risk seviyelerini artırıp artırmadığını ve dolayısıyla iflas riski ile ilişkilendirilip ilişkilendirilemeyeceğini ortaya koymayı amaçlamaktadır. Çalışmada Borsa İstanbul'da işlem gören finans sektörü ve holdingler hariç 50 adet işletmenin 2017-2023 yılları arasındaki yıllık verileri Panel EGLS yöntemiyle analiz edilmiştir. Analiz sonuçlarına göre, aşırı büyüme ile iflas riski arasında negatif bir ilişki bulunmuştur. Bu bulgu, aşırı büyümenin artması durumunda Altman Z-Skorunun düştüğünü, yani iflas riskinin arttığını göstermektedir. İşletmelerde hızlı büyüme, yüksek sermaye gereksinimleri doğurması ve borçlanmayı artırması sebebiyle finansal yapının bozulmasına, likidite sorunlarına ve nihayetinde iflas riskinin artmasına yol açabilir. Bu nedenle, işletmelerin büyüme oranlarını yönetirken sürdürülebilir büyüme oranlarını dikkate almaları kritik öneme sahiptir.

Anahtar Kelimeler*: *Finansal Risk Yönetimi*, *Sürdürülebilir büyüme, Aşırı büyüme, İflas riski, Altman Z
JEL Sınıflandırması:* *G23, G33, M21

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1. INTRODUCTION

In business literature, growth is generally considered a positive performance indicator, and there is a common misconception that growth benefits businesses under all circumstances. The assumption that higher growth rates automatically increase business success ignores the consequences of excessive growth, such as rapidly increasing costs, heavier debt burdens, and increased financial losses. This, in turn, causes businesses to experience financial stress. This can result in a decline in market share, the loss of qualified employees, or crises that can even lead to bankruptcy. Therefore, it can be argued that growth is beneficial up to a certain point, but beyond a certain point, it threatens sustainability. In this context, sustainable growth enables businesses to build their expansion capacity on a balanced and stable basis. Sustainable growth serves not only the survival of businesses but also the preservation of their long-term competitiveness (Fonseka et al., 2012:481). The concept of sustainable growth rate is a view proposed by Higgins (1977), which argues that each company's financial policies differ depending on its objectives. Accordingly, the core business areas that drive sales growth should be aligned with the factors reflected in financing decisions (Junaidi et al., 2019:309). The sustained performance and financial robustness of organizations depend on the effective management of their growth strategies. In this context, the sustainable growth rate (SGR) emerges as a key metric, reflecting the extent to which a firm can grow without relying on external financing, while maintaining its current capital structure (Higgins, 1977: 7-16). SGR is directly linked to a firm's profitability, dividend policy, and debt repayment capacity. However, deviations from the SGR, whether in the form of excessive or insufficient growth, can jeopardize financial stability and increase the risk of bankruptcy. If a firm grows at a rate higher than its SGR, it may face financial distress, leading potentially to insolvency. To support such rapid growth, the firm might need to issue new equity, increase its debt levels, modify its dividend policy, improve production efficiency, or enhance its asset turnover ratio (Momčilović, et. al.,2015 :63-75). Similarly, as Higgins (2012) points out, rapid growth can place significant pressure on a company's resources, and if management is unaware of this strain or fails to take proactive measures, it can lead to bankruptcy. Although expanding sales and earnings are typically considered essential metrics for evaluating business performance (Momčilović, et. al.,2015:63-75), rapid increases in these areas are not necessarily desirable. Growth should not always be maximized indiscriminately.

Excessive growth can prompt businesses to rapidly increase capital expenditures in line with their strategic decisions, often leading to higher levels of debt to finance this growth. This situation can result in short-term liquidity challenges and long-term financial distress. The literature presents numerous studies indicating that excessive growth negatively impacts firms' financial performance and survival prospects (Chen and Hambrick, 1995; Lang et al., 1996). In particular, the deterioration of capital structure and increased borrowing weaken firms' operational flexibility, thereby raising the risk of bankruptcy (Opler and Titman, 1994: 1017).

Similarly, while Churchill and Mullins (2001) acknowledge that growth is a critical element in achieving business success, they highlight the financial challenges that must be carefully managed if companies are to achieve sustainable growth. Growth is not merely about increasing revenue and profitability; it also demands greater capital requirements and careful management of working capital. If the rate of growth occurs uncontrollably, the company may face liquidity issues, which could lead to financial distress.

Particularly, the effects of excessive growth on financial leverage and the challenges of managing cash flows are cited as key factors leading companies into financial distress (Opler and Titman, 1994). Chen and Hambrick (1995) note that over-expansion strategies often surpass a company's financial capacity, increasing debt levels and thereby creating financial pressures. Similarly, Lang, Ofek, and Stulz (1996) demonstrate that excessive borrowing and rapid growth contribute to financial instability and raise the risk of bankruptcy. To manage growth from a financial perspective, several strategies are recommended.

Various approaches to measuring sustainable growth exist in the literature, based on general SGR models developed by Higgins (1977) and Van Horne (1987). These include Platt et al. (1995) with an SGR model adapted to financial distress, Jagers (2003) with an SGR model adapted to nonprofit organizations, Hamman (1996) with a cash flow-based SGR model, and Escalante, Turvey, and Barry (2009) with sustainable growth models that consider specific situations in the agricultural sector, measuring sustainable growth in different sectors (Fonseka, 2012:482) Despite its usefulness, SGR is limited by being a non-dynamic measure**.** SGR calculations typically rely on current financial data and do not take into account future variables or market conditions. Additionally, SGR is constrained by the company's existing capital structure and profitability ratios, meaning it does not consider factors such as the firm's potential for growth through innovation, market expansion, or new strategic initiatives Some sources emphasize that SGR has a significant signaling effect for businesses, generally arguing that a high SGR sends positive signals. (Kanani, et. al.,2013: 660-667). Conversely, Jagadish (2011) argues that exceeding the sustainable growth rate leads to overexpansion, increasing debt, which in turn raises the firm's future costs and risks. He further notes that excessive growth can deplete financial resources, negatively impacting the firm's credit reputation.

Platt, et.al. (1995) argue that SGR can serve as a crucial tool in crisis management. Firms facing financial distress should assess their current sustainable growth rates and develop strategies to improve these rates. The authors emphasize that to overcome financial difficulties, a firm should optimize its internal resources without relying on external financing. When the SGR is low, firms may be unable to finance new investments or sustain growth. Therefore, financially distressed companies must enhance operational efficiency and restructure profitability to increase their sustainable growth rate. A low SGR not only heightens the likelihood of bankruptcy but also raises the cost of external financing due to the deterioration of the firm's financial structure. The authors contend that by improving their SGR in the long term, distressed firms can increase their chances of survival (Platt et al., 1995:147-151).

The sustainable growth rate (SGR) and bankruptcy risk are two critical financial metrics that frequently intersect in corporate finance. SGR reflects the rate at which a company can grow its sales, earnings, and assets without the need to increase financial leverage, while bankruptcy risk indicates the likelihood of a company failing to meet its financial obligations, leading to financial distress or insolvency. Understanding the relationship between these two measures is essential for corporate managers, investors, and analysts, as it provides insights into how growth strategies may impact a company's financial stability. If the realized growth rate is greater than the sustainable growth rate, management's focus shifts to generating cash to fund expansion. Conversely, when actual growth falls below sustainable growth, the financial agenda may shift towards productively allocating excess cash flow (Higgins, 2012 :141). This study will examine the impact of deviations from SGR on bankruptcy risk, particularly analyzing the role of overexpansion on financial stability. The results are anticipated to offer meaningful guidance for maintaining firms' financial stability., the effective management of growth strategies, and the mitigation of financial risks. Additionally, this research is expected to add to the theoretical advancement within academia**.** and aid in making more effective management decisions in day-to-day business practices.

2. LITERATURE

This section of the study includes academic studies on sustainable growth from past to present. Research typically centers around how deviations from SGR influence firms' financial indicators or what factors shape sustainable growth.

Rajan and Zingales (1998) demonstrate that industries with high financial dependence rapid growth is more common among firms operating in countries with advanced financial systems.These findings highlight the importance of financial markets for economic growth and suggest that the development of a country's financial system is particularly crucial in capital-intensive sectors. Bivona (2000), in his study on the relationship between sustainable growth policies and profitability, emphasizes that sustainable corporate entities rely on three key pillars: resource structure, operational activities, and management practices. Amouzesh et al. (2011) analyzed the relationship between sustainable growth rates, corporate performance, and liquidity across 54 companies listed on the Iranian capital market. Their findings reveal a connection between deviations from the sustainable growth rate (SGR) and both book value and return on assets. Pandit and Tejani (2011) stress that in India's textile and apparel sector, companies must carefully manage asset utilization, operational efficiency, and financial leverage to ensure sustainable growth. They note that rapid growth in the retail sector, if not aligned with the SGR, can lead to financial distress in the long term.

Ataünal and Gürbüz (2016) investigated the relationship between excessive growth and shareholder value using data from 167 companies listed on the Borsa Istanbul. They found that growth significantly exceeding the SGR resulted in value loss for shareholders. Fonseka et al. (2012), using data from 15,377 U.S. companies between 2000 and 2008, concluded that a firm's financial characteristics have a stronger impact on sustainable growth. Chen et al. (2012) suggest that aggressive growth targets can endanger a company's financial sustainability. Additionally, their analysis of dividend payout ratios indicates that an optimal dividend strategy directly influences a company's growth capacity and the value it delivers to shareholders.

Hartono and Utami (2016) analyzed the impact of SGR on corporate performance and value in the IDX30 Index, which includes the 30 largest companies in Indonesia by market capitalization and liquidity. Their study found that SGR had a positive and significant effect on asset profitability but a negative and insignificant impact on the price-to-earnings ratio. No significant relationship was found between SGR and the current ratio. Higgins (1977) suggested that more profitable firms tend to have higher SGRs due to effective investment in fixed assets, efficient working capital management, and higher tax liabilities. Johnson and Soenen (2003), using data from 478 companies between 1982 and 1998, found that the most successful companies in terms of high sustainable growth were those with unique business characteristics and efficient capital management.

Lin (2024), in a study using data from companies listed in China between 2009 and 2021, found that Environmental, Social, and Governance (ESG) performance had a positive impact on achieving a sustainable growth rate. Xiyuan and Jingui (2015) emphasize that financial indicators such as capital efficiency, return on equity (ROE), and leverage levels significantly influence a company's sustainable growth capacity in companies listed on GEM. High leverage ratios were generally found to have a negative impact on sustainable growth.

Rahim (2017) examined the relationship between growth performance and SGR for firms listed on the Malaysian stock exchange, analyzing the effects of factors such as financial leverage (debt ratio), liquidity (current ratio), and asset efficiency on SGR. The study found that firms with higher debt ratios had higher SGRs, however, liquidity was not found to have a statistically significant effect**.**, tax rates, and SGR. Şahin and Ergün (2018), using data from 69 manufacturing firms listed on BIST between 2013 and 2015, examined the impact of deviations from the SGR on asset profitability, return on equity, price-to-earnings ratio, debt ratio, and current ratio. The study found a negative relationship between deviations from SGR and both asset and equity profitability.

Şahin (2020), in a study of 93 firms selected from the top 1,000 industrial companies in Istanbul (ISO 1000), evaluated the relationship between debt utilization and ROE, distinguishing between high and low growth companies**.** The study found that slow-growing companies effectively used debt to generate a financial leverage effect, thereby increasing equity profitability. Yaman and Gür (2023), analyzing data from firms listed on the BIST100 index from 2010 to 2022, found that financial risks significantly explained changes in profitability and financial sustainability variables.

In their study examining new ventures in Portugal over the period 2010–2016, Patel et al. (2020) found that firms with higher levels of sustainable growth and stability were more likely to continue their operations in sectors with a higher return on investment. Mubeen et al. (2021) compared the sustainable growth performance of firms that issued secondary equity and those that did not, using data from seven emerging markets over the period 2000–2015. The results show that leverage and firm size, along with secondary equity issuance, are determinants of sustainable growth. Ocak and Fındık (2019) investigated the effects of intangible assets and their components on the sustainable growth and value of firms in Turkey. The results of the study show that intangible assets have a significant positive effect on the sustainable growth rate and value of firms. Smart et al. (2019) examined sustainable growth rates and growth pain metrics in grain marketing and agricultural supply cooperatives in the United States. Their findings revealed that cooperatives can compensate for situations that exceed sustainable growth through financial leverage and short-term operational efficiency; however, some cooperatives face a high risk of failure due to persistent growth pain. Mamilla (2019) emphasizes that firm size and debt-equity ratio have significant and negative effects on the sustainable growth rate, therefore, businesses should carefully plan their leverage levels to ensure sustainability. Nastiti et al. (2019), in a study conducted on 136 manufacturing firms in Indonesia during the period 2010-2017, revealed that working capital management significantly affects profitability, but its effect on sustainable growth is indirectly realized through profitability. Sanoran (2023) examined the impact of corporate sustainability on the sustainable growth performance of companies operating in various sectors. The study findings indicate that corporate sustainability significantly and positively supports sustainable growth in companies operating in the Industry and Real Estate & Construction sectors. However, the same effect was not observed in the Agriculture and Food Industry, Resources, Services, and Technology sectors.

3. DATA AND METHODOLOGY

This research investigates whether deviations from sustainable growth (measured as AGR minus SGR) influence the bankruptcy risk of firms.The analysis focuses on 50 companies listed on Borsa Istanbul, excluding financial institutions and holding companies. The analysis period for this study is 2017-2023. This period aims to examine the recent sustainability trends of companies traded on the Borsa Istanbul, and data from these companies can be obtained continuously and regularly. The selected timeframe allows for the examination of short- and medium-term sustainability outcomes.

In this study, firms were first categorized into those with excessive growth and those with insufficient growth, and 50 firms identified as exhibiting excessive growth were included in the analysis. To make this distinction, the actual growth rate (AGR) of net sales was compared with the sustainable growth rate (SGR). By subtracting the SGR from the AGR, the difference between actual growth and sustainable growth (AGR-SGR) was examined. It was observed that in some years, firms grew above their sustainable growth rate, while in others, they grew below it. Only the firms with excessive growth were included in the analysis, and a panel regression model was developed accordingly.

The following equation represents the panel regression model applied in this research:

$$Z'' \text{ Score}_{it} = \alpha_{0,it} + \beta_{1,it} (AGR\text{-}SGR)_{it} + \varepsilon_{it} \quad (1)$$

$i = 1, \ldots, N$ $t = 1, \ldots, T$

In the model (1), i represents the cross-sectional unit, and t is the time dimension.

This study adopts the widely-used Higgins (1977) SGR model, which models sales growth aligned with firms' financing and operating policies. SGR was calculated by multiplying the return on equity by the retention rate ($SGR = R \times ROE_{bp}$) by taking other studies in the literature (Pandit and Tejani, 2011; Hartono and Utami, 2016; Amouzesh et al. 2011, Momčilović et al. 2015; Jagadish, 2011).

The basic formula for calculating the Sustainable Growth Rate (SGR) is:

$$SGR=R \times ROE_{(bp)} \quad (2)$$

Where;

$ROE_{(bp)}$ (Return on equity at the begining period) measures how effectively a company is using its equity. The retention rate (R) was calculated as follows:

$$R = \frac{The\ part\ of\ previous\ year's\ net\ profit\ that\ wasn't\ distrbuted\ as\ dıvıdend}{net\ profit\ for\ the\ period} \quad (3)$$

This calculation is also consistent with other studies on sustainable growth (Amouzesh et al., 2011; Şahin and Ergün, 2018; Pandit and Tejani, 2011).

In the study, excessive growth was measured by the difference between AGR and SGR, and AGR, which represents real growth, was calculated as follows. It is seen that the same equation is used in similar studies. (Higgins,1977; Şahin and Ergün,2018; Amouzesh et.al.,2011) The calculation of AGR, which represents the real growth rate in the study, is shown in the following equation:

$$AGR = \frac{Current\ year-end\ sale\ amount}{previous\ year-end\ sale\ amount} \quad (4)$$

Companies that made a period loss were not included in the analysis. The reason for this is that period loss causes a negative SGR and if there is a positive AGR, it causes the AGR-SGR difference to appear very high (Şahin and Ergün,2018: 181).

In this study, firms' bankruptcy risk is represented by the Altman Z-Score. Developed by Edward Altman in 1968, the Z-Score model is a globally recognized tool for predicting bankruptcy and financial distress. The model employs a multiple discriminant analysis based on five key financial ratios, which assess a firm's financial health by considering factors such as liquidity, profitability, financial leverage, activity ratios, and market value compared to debt. By utilizing data such as total assets, equity, and sales, the model estimates a firm's likelihood of bankruptcy. multiple iterations of the model have emerged over the years.including the Z'-Score for private companies and the Z"-Score for both publicly traded and private firms. Based on their Z-scores, firms are classified into three zones: safe, gray, or distressed. Table 1 illustrates the classification of firms into these zones based on their scores.

Table 1. Altman Z Scores and Ranges

Altman Z-Score Classifications for Listed Manufacturing Firms (Altman 1968)	Altman Z-Score Benchmarks for Private Manufacturing Firms (Altman 2000)	Privately Owned Service Sector Firms (Altman 2000)
Z score>2.99 safe zone	Z score>2.90 safe zone	Z score>2.60 safe zone
1.8≤Z score ≤2.99 gray zone	1.23≤ Z score ≤2.90 gray zone	1.10≤ Z score ≤2.60 zone
Z score<1.8 risky zone	Z score<1.23 risky zone	Z score <1.10 risky zone

Source: Yıldız, 2014:75

In the study, the Altman Z score developed for listed manufacturing firms was used to determine the bankruptcy risk of companies and its formulated form is shown in the figure below.:

$$Z = 1{,}2X1 + 1{,}4X2 + 3{,}3X3 + 0.06X4 + 0.999X5 \quad (5)$$

The variables in this formula are as follows:

X1 = (Working Capital / Total Assets): Indicates the company’s short-term liquidity and ability to meet its obligations.

X2 = (Retained Earnings / Total Assets): Represents the proportion of the company's retained earnings relative to its total assets.

X3 = (Earnings Before Interest and Taxes (EBIT) / Total Assets): Reflects how efficiently the company uses its assets and its operational profitability.

X4 = (Equity / Total Liabilities): Measures the extent to which the company’s debts are supported by its equity, thereby indicating financial risk.

X5= Sales / Total Assets

Altman et al. (2000) demonstrated that accounting-based prediction models generally provide accurate results, but when factors such as country and industry are considered, the outcomes can be even more reliable. The Z-Score model remains a vital tool for banks, investors, and financial institutions, playing a crucial role in risk management and credit allocation.

Studies conducted in Turkey also support the efficacy of this model. Tekin and Gör (2022) found that the revised version of the Altman Z-Score model effectively predicted the financial failures of banks. Similarly, Van et al. (2021) analyzed 139 manufacturing companies listed on Borsa Istanbul (BIST) and concluded that the Altman Z-Score model is a reliable tool for forecasting financial distress and bankruptcy risk. Kulalı (2016) examined data from bankrupt companies listed on BIST between 2000 and 2013 and noted that the model’s predictive power is quite strong.

Panel data offers significant advantages over cross-sectional or time series data. Panel data allows for more reliable estimation of model parameters and the development and testing of more complex behavioral hypotheses. These data allow for the identification of dynamic relationships and the production of more accurate forecasts. Furthermore, it provides a strong foundation for aggregate data analysis through micro-based datasets. (Hsiao, 2005:147-148) In this study, the panel EGLS method was applied. The Panel-EGLS method is a generalized least squares approach that combines features of fixed- and random-effects models to account for heterogeneity and autocorrelation in panel data. The relevant literature (Mance,2020, Sugandi,2022) highlights Panel-EGLS as the most appropriate estimation procedure under these conditions. This method provides consistent and efficient estimates when faced with problems of autocorrelation and heteroskedasticity (Ullah et al, 2023: 6).

4. RESULTS

Before starting the analysis, summary statistical information about the variables was defined and given in Table 2.

Table 2. Summary statistics

	AGR-SGR	Z
Std. Dev.	23219828	1.470170
Jarque-Bera	149125.3	363.8239
Probability	0.000000	0.000000

The Jarque–Bera test results were significant for both variables (p = 0.000), thus the assumption of normal distribution is not met. However, the number of observations in the data set increases the reliability of parametric estimates, as required by the Central Limit Theorem. Since the EGLS (Estimated Generalized Least Squares) method used in panel data analysis has the ability to correct for heteroskedasticity and autocorrelation, failure to meet normal distribution does not hinder estimations.

Cross-sectional independence assumes that the degree to which all companies are affected by a shock to any of the units forming the panel is the same and that a shock occurring in one of the companies is not affected by the other companies forming the panel. Whether or not the cross-sectional dependency between the series is taken into account significantly affects the results to be obtained (Breusch and Pagan, 1980; Pesaran, 2004). Since the results obtained in the analyses without taking the cross-sectional dependency into account will be biased and inconsistent, the cross-sectional dependency between the series should be taken into account before starting the analysis in panel data (Menyah et al. 2014: 389).

Breusch-Pagan LM (1980), Pesaran LM, and Pesaran CD tests were employed to examine whether cross-sectional dependence exists in the series. The assessment was conducted both at the model specification level and across the panel data, and the findings are displayed in the table.

Table 3. Cross Section Test for Series AGR-SGR

Test	Statistic	d.f.	Prob
Breusch-Pagan LM	2080.911	1653	0.0000
Pesaran scaled LM	7.442210		0.0000
Bias-corrected scaled LM	2.608876		0.0091
Pesaran CD	2.704595		0.0068

Table 4. Cross Section Test for Series Altman Z’’ Score

Test	Statistic	d.f.	Prob
Breusch-Pagan LM	3010.127	1653	0.0000
Pesaran scaled LM	23.60310		0.0000
Bias-corrected scaled LM	18.76976		0.0000
Pesaran CD	1.104916		0.2692

Since the time dimension of the study is smaller than the cross-sectional dimension (N>T), the Pesaran CD (2004) test statistic results have been considered. Examination of cross-sectional dependence tests for each variable also reveals similar outcomes. The fact that the probability values for the AGR-SGR variable fall below the 0.05 threshold supports the rejection of the null hypothesis, thereby confirming the presence of cross-sectional dependence within the panel dataset. For the Altman Z score, the ascending CD test yields probability values greater than 0.05, indicating that the null hypothesis of no cross-sectional dependence cannot be rejected. This confirms the absence of cross-sectional dependence in the panel data. Consequently, while unit root tests accounting for cross-sectional dependence should be applied to the AGR-SGR difference, this requirement does not apply to the Altman Z variable**..**Unit root tests in panel data test whether series are stationary in data with both cross-section and time dimensions. Unlike unit root tests that look at a single series, these tests are applied to the entire panel data set. The absence of a unit root in a series, that is, the series being stationary, means that the mean and variance of the series are constant over time. Stationary series have predictable properties, which is important for making reliable estimates in economic models. Non-stationary series, on the other hand, may produce incorrect results in econometric analyses because they do not have a specific structure (Levin et.al, 2002: 1-24). In this study, considering the presence of cross-sectional dependence, the widely used PANIC test was employed, and the results are presented in Table 5 and Table 6.

Table 5. Unit Root (PANIC) test for AGR-SGR

	Value	**p-value**
AGR-SGR (constant)	-6.66383	0.00000

Table 6. Unit Root test for Altman Z'' score

Individual Intercept	**Statistic**	**Prob.**
Levin, Lin & Chu t*	-418.674	0.0000
Im, Pesaran and Shin W-stat	-414.099	0.0000
ADF - Fisher Chi-square	156.548	0.0000
PP - Fisher Chi-square	429.120	0.0000
Individual Intercept and Trend	**Statistic**	**Prob.**
Levin, Lin & Chu t*	-481.794	0.0000
Breitung t-stat	-0.91251	0.0180
Im, Pesaran and Shin W-stat	-477.086	0.0000
ADF - Fisher Chi-square	217.709	0.0000
PP - Fisher Chi-square	352.727	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Given that the PANIC test statistic is smaller than the critical value, the null hypothesis asserting the presence of a unit root in the panel data is rejected, suggesting stationarity. Additionally, the Altman Z variable is found to be stationary, as all test criteria yield p-values below 0.05.

Tests were applied to determine whether the panel model should be estimated with fixed effects, random effects or pooled method. Whether the AGR-SGR difference can be estimated with the pooled least squares method, which examines the effect of the bankruptcy risk of the enterprises, was examined with the Breusch-Pagan Lagrange Multiplier.

Table 7. F, LM and Hausman Test

Test Type	Value	p-Value
F test	9.760478	0.0000
LM test	2.330885	0.0000
Hausman Test	42053.586	0.0000

In the F test, a p-value lower than the critical value leads to the rejection of the null hypothesis. This implies that significant individual effects exist, making the fixed effects model the appropriate choice. As the pooled model was found to be inappropriate, a Hausman test was conducted to decide whether a fixed effects or random effects model should be used in the subsequent stage of the analysis. The Hausman test is used to choose between fixed and random effects models.

H_0: The random effects model is suitable (no systematic difference between estimators).

H_1: The fixed effects model is preferable (systematic difference exists).

Since the p-value is under 0.05, H_0 is rejected, and the fixed effects model is selected.

Autocorrelation is a problem when the error term in one observation is correlated with the error terms in other observations. Autocorrelation can occur in panel data in both time and cross-sectional dimensions. The presence of autocorrelation weakens the predictive power of the model and the validity of statistical tests. For example, if autocorrelation is present, standard error estimates can become biased and inconsistent, leading to incorrect t-test and F-test results. Heteroskedasticity refers to the situation where the error terms do not have constant variance. That is, if the variance of the error terms changes as the number of observations increases, then there is a problem of heteroskedasticity. This leads to incorrect calculations of standard error estimates and, as a result, unreliable t-test and F-test results.

In this study, the Wald test was applied to test the heteroscedasticity of the model, and the Durbin Watson test was applied to test the autocorrelation.

Table 8. Heteroscedasticity and Autocorrelation

Test	Value	Probability
Wald	-9.851217	0.0000
Durbin-Watson	1.103178	

As seen in the table 8, it was found that the null hypothesis was rejected because the Wald test statistic probability value was below the critical value, that is, the variance of the error terms was not constant and there was a heteroskedasticity problem. On the other hand, when the sample size of the study is taken into account, it is seen that the dl (lower limit) value of the d statistic is 1.134 and the du (upper limit) value is 1.685 in the Durbin Watson d statistic table. The fact that the Durbin Watson statistic result (1.103178; $0<d<dl$) is below the lower limit in the study proves the existence of autocorrelation. The existence of heteroscedasticity and autocorrelation problems and cross-sectional dependence were determined in the model. In panel data models, it is recommended to use the panel-EGLS method in cases where there is autocorrelation and heteroscedasticity between errors both simultaneously and over time (Mance et al., 2020).

Table 9. Panel EGLS Test Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGR-SGR	-0.012887	0.005235	-2.461628	0.0145
C	0.213628	0.015850	13.47816	0.0000
Weighted Statistics				
R-squared	0.628768		Mean dependent var	0.556281
Adjusted R-squared	0.566655		S.D. dependent var	0.495566
S.E. of regression	0.375708		Sum squared resid	36.27729
F-statistic	10.1200		Durbin-Watson stat	2.155118
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.597855		Mean dependent var	0.174872
Sum squared resid	47.24287		Durbin-Watson stat	3.176511

When the table is examined, the effect of the positive difference of AGR-SGR, which is an indicator of excessive growth, on the Altman Z ratio, which is the bankruptcy risk, is statistically significant and negative. This result shows that excessive growth increases the risk of bankruptcy.

5. CONCLUSION

In financial management and firm performance analyses, the difference between the sustainable growth rates (SGR) and actual growth rates (AGR) of businesses, i.e. excessive growth, is an important indicator. Excessive growth occurs when the actual growth rate of a business exceeds the sustainable growth rate. This situation means that the business grows by exceeding the available resources and generally becomes dependent on external financing sources. This study evaluates the effect of excessive growth (positive AGR-SGR) on the bankruptcy risk of businesses through simple regression analysis. Bankruptcy risk was measured by Altman Z-Score and the effect of excessive growth on this risk is important in terms of evaluating financial sustainability. In the study, a panel regression model was established to examine the effect of excessive growth on the bankruptcy risk of businesses. Excessive growth (AGR - SGR) was used as the independent variable and Altman Z-Score was used as the dependent variable. Altman Z-Score is a common metric that measures the financial health and bankruptcy risk of businesses and therefore is a suitable indicator for the assessment of bankruptcy risk.

The analysis results indicate a negative association between excessive growth and the risk of bankruptcy.This finding shows that when excessive growth increases, the Altman Z-Score decreases, meaning that the risk of bankruptcy increases. This result, which has a negative coefficient for excessive growth, is consistent with financial theories. High growth rates usually result in businesses exceeding their current capacity and financial resources. This situation creates the risk that the business will become dependent on external financing sources and that its financial structure will deteriorate. Therefore, excessive growth has an effect that increases the risk of bankruptcy for businesses. The findings clearly reveal the negative effects of excessive growth on companies. The rapid growth of businesses usually creates high capital requirements, which increases debt. The increase in debt can lead to financial structure deterioration, liquidity problems, and ultimately an increase in the risk of bankruptcy. Therefore, it is critical for businesses to consider sustainable growth rates when managing their growth rates.

The negative relationship revealed by the study shows that especially businesses that follow an excessive growth strategy should pay more attention to financial risk management. During excessive growth periods, businesses tend to take on more debt in order to sustain their current operations and finance growth.

When the literature is examined, There is no study observed that directly examines the effect of excessive growth on bankruptcy risk in Türkiye, there are studies that find the financially negative consequences of excessive growth for businesses. For example; Ataünal and Gürbüz (2016) found that excessive growth leads to a loss of value for shareholders, Amouzesh et al. (2011) found in their studies that there is a relationship between deviation from the sustainable growth rate and book value and return on assets, Saputro and Purwanto (2013) found that some determinants such as ROA, current ratio and acid ratio affect the deviation of the sustainable growth rate from the real growth rate, Şahin (2020) found that debt is used effectively in slow-growing businesses and increases equity profit by creating a financial leverage effect. In these aspects, it can be concluded that this study reaches similar results with similar studies long term and increases the possibility of facing bankruptcy risk.

This study aims to contribute to the literature by providing evidence that excessive growth directly increases the risk of bankruptcy. The study adds a new dimension to the financial management and risk management literature by supporting empirical evidence that bankruptcy risk can increase when the sustainable growth rate is exceeded. Furthermore, the study's inclusion of real sector firms traded on the Borsa Istanbul contributes to the understanding of the relationship between sustainable growth and bankruptcy risk in emerging markets.

This study has limitations. First, the analysis covers only 50 companies listed on the Istanbul Stock Exchange. Therefore, the findings cannot be directly generalized to different sectors or countries. On the other hand, the 2017-2023 period represents a relatively short analysis interval and does not cover the effects of different economic cycles. Furthermore, only the Altman Z-Score was used in the study. Comparisons with different bankruptcy risk indicators could increase the generalizability of the results. Future studies could be expanded to different sectors and countries, providing a more general perspective on the relationship between sustainable growth and bankruptcy risk. The analysis period includes the COVID-19 pandemic. While this represents a major global shock, it is believed not to introduce systematic bias into the overall model because the method used allows for controlling for period and unit effects. However, the potential structural effects of the pandemic should be considered a limitation in the interpretation of the results.

Ethics

The study titled "DEVIATION FROM SUSTAINABLE GROWTH AND BANKRUPTCY RISK IN BUSINESSES" was conducted and published in accordance with the principles of research and publication ethics. No manipulation or falsification was made on the data used in the study. Due to the nature of the research, ethics committee approval is not required.

Contribution Declaration

All authors actively contributed to the writing of the study, the preparation of the draft, and the entire research process, and have read and approved the final version of the manuscript.

Conflict of Interest Declaration

This study did not lead to any conflict of interest, both institutionally and individually.

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Extended Abstract

Deviation From Sustainable Growth and Bankruptcy Risk In Businesses

Aim: The sustainable growth target of businesses is one of the basic principles of modern financial management. However, failure to achieve sustainable growth, excessive or inadequate growth can pose serious risks to the financial health of businesses. At this point, the relationship between excessive growth (AGR - SGR positive difference) and bankruptcy risk is considered important in terms of management strategies and investment decisions of businesses. The sustainable growth rate (SGR) and bankruptcy risk are two critical financial metrics that frequently intersect in corporate finance. SGR reflects the rate at which a company can grow its sales, earnings, and assets without the need to increase financial leverage, while bankruptcy risk indicates the likelihood of a company failing to meet its financial obligations, leading to financial distress or insolvency. Understanding the relationship between these two measures is essential for corporate managers, investors, and analysts, as it provides insights into how growth strategies may impact a company's financial stability. When actual growth exceeds sustainable growth, management's focus shifts to generating cash to fund expansion. Conversely, when actual growth falls below sustainable growth, the financial agenda may shift towards productively allocating excess cash flow (Higgins, 2012, p. 141). This study will examine the impact of deviations from SGR on bankruptcy risk, particularly analyzing the role of overexpansion on financial stability. This study aims to reveal whether the growth of businesses above their sustainable growth rates increases their financial risk levels and therefore whether it can be associated with bankruptcy risk.

Method: In the study, the annual data of 50 businesses traded on Borsa Istanbul, excluding financials and holdings whose data can be accessed without interruption, between the years 2017-2023 were analyzed using the Panel EGLS method. In the study, the Higgins (1977) SGR model, which is widely used among growth models that model sales growth compatible with the financing and activity policies of companies, and the Altman Z score were used to represent bankruptcy risk.

Findings: According to the analysis results, a negative relationship was found between excessive growth and bankruptcy risk This finding shows that when excessive growth increases, the Altman Z-Score decreases, meaning that the risk of bankruptcy increases. This result, which has a negative coefficient for excessive growth, is consistent with financial theories. High growth rates usually result in businesses exceeding their current capacity and financial resources. This situation creates the risk that the business will become dependent on external financing sources and that its financial structure will deteriorate. Therefore, excessive growth has an effect that increases the risk of bankruptcy for businesses. The findings clearly reveal the negative effects of excessive growth on companies. The rapid growth of businesses usually creates high capital requirements, which increases debt. The increase in debt can lead to financial structure deterioration, liquidity problems, and ultimately an increase in the risk of bankruptcy. Therefore, it is critical for businesses to consider sustainable growth rates when managing their growth rates.

Conclusion: The negative relationship revealed by the study shows that especially businesses that follow an excessive growth strategy should pay more attention to financial risk management. During excessive growth periods, businesses tend to take on more debt in order to sustain their current operations and finance growth. this study aims to contribute to the literature by providing evidence that excessive growth directly increases the bankruptcy risk. This situation offers important managerial implications, especially for companies that are growing rapidly or aiming for expansion. In future studies, similar studies can be conducted on different sectors (e.g. technology, manufacturing, services) and geographic regions (developed countries vs. developing countries) to examine how excessive growth affects the bankruptcy risk and to examine the generalizability of the findings. Segmentation by sector can help determine which sectors are more sensitive to the risk of excessive growth. A broader framework can be drawn by analyzing how macroeconomic variables (e.g. interest rates, inflation, exchange rate volatility) affect the relationship between excessive growth and bankruptcy risk.