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Financial distress in the hotel industry: Evidence from a multidimensional performance framework

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Abstract

Purpose – This study examines the multidimensional determinants of financial distress in joint-stock hotel companies using the KRAS framework, comprising the continuity, reputation, activity, and structure dimensions. The objective is to identify which dimensions best distinguish Altman-defined financial distress zones. **Methodology** – The empirical analysis is based on 97 firm-year observations from 17 joint-stock hotel companies in Serbia during 2019–2024. Financial distress is assessed using the Altman Emerging Market Score (EMS), classifying observations into distress, grey, and safe zones. Because the data are not normally distributed, differences among groups are examined using the Kruskal–Wallis test, followed by Bonferroni-adjusted Mann–Whitney U tests. **Findings** – The structure dimension shows the strongest discriminatory ability across Altman-defined financial distress zones, with S1 emerging as the most informative indicator. The continuity and activity dimensions also show statistically significant differences, although with smaller effect sizes, whereas the reputation dimension does not demonstrate significant discriminatory power. **Implications** – The findings confirm the value of the KRAS framework as a multidimensional approach to assessing financial distress in the hotel sector and provide useful insights for managers, investors, and creditors in evaluating financial resilience and vulnerability.

Keywords: financial distress, hotel industry, KRAS framework, Altman Emerging Market Score (EMS), multidimensional analysis, non-parametric methods

JEL classification: G33, G32, C14, L83

Finansijske teškoće u hotelijerstvu: Empirijska analiza u okviru višedimenzionalnog modela finansijskih performansi

Sažetak

Cilj – Ova studija ispituje multidimenzionalne determinante finansijskih teškoća u akcionarskim hotelskim preduzećima koristeći KRAS okvir, koji obuhvata dimenzije kontinuiteta, reputacije, aktivnosti i strukture. Cilj je da se identifikuje koje dimenzije najbolje razlikuju Altmanove zone finansijskih teškoća. **Metodologija** – Empirijska analiza zasniva se na 97 opservacija preduzeće–godina (*firm-year observations*) koje se odnose na

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17 hotelskih akcionarskih preduzeća u Srbiji tokom perioda 2019–2024. Finansijske teškoće procenjuju se primenom Altmanovog modela za tržišta u razvoju (*Emerging Market Score – EMS*), pri čemu se opservacije klasifikuju u tri zone: zonu finansijskih teškoća, sivu zonu i sigurnu zonu. Pošto podaci nisu normalno distribuirani, razlike među grupama se ispituju korišćenjem Kruskal-Volisovog testa, a zatim i Man–Vitnijevih U testova uz Bonferonijevu korekciju. **Rezultati** – Dimenzija strukture pokazuje najjači diskriminatorni kapacitet u svim Altmanovim zonama finansijskih teškoća, pri čemu se S1 izdvaja kao najinformativniji indikator. Dimenzije kontinuiteta i aktivnosti takođe pokazuju statistički značajne razlike, iako sa manjim veličinama efekta, dok dimenzija reputacije ne pokazuje značajnu diskriminatornu moć. **Implikacije** – Rezultati potvrđuju vrednost KRAS okvira kao multidimenzionalnog pristupa proceni finansijskih teškoća u hotelskom sektoru i pružaju korisne uvide menadžerima, investitorima i kreditorima u proceni finansijske otpornosti i ranjivosti.

Ključne reči: finansijske teškoće, hotelijerstvo, KRAS okvir, Altmanov EMS model, multidimenzionalna analiza, neparametarske metode

JEL klasifikacija: G33, G32, C14, L83

1. Introduction

Financial distress is a primary analytical focus of corporate finance, particularly in sectors with high operational risk and exposure to external shocks. One of the most vulnerable sectors is the hotel sector, due to its susceptibility to fluctuations in demand, seasonality, and macroeconomic conditions, with external shocks, such as economic crises, significantly affecting the financial sustainability of firms (Crespi-Cladera et al., 2021; Song & Witt, 2000;). Although the determinants and consequences of financial distress have been relatively widely documented in the literature, no clear consensus has yet emerged regarding the most relevant indicators for its early identification (Habib et al., 2020). Classical approaches to the analysis of financial distress primarily rely on accounting-based indicators of profitability, indebtedness, and solvency (Altman, 1968; Beaver, 1966; Ohlson, 1980). The diversity of determinants identified in the literature to date suggests that financial distress is a complex and multidimensional phenomenon (Habib et al., 2020) that requires the simultaneous consideration of multiple financial dimensions and more integrated analytical approaches (Seretidou et al., 2025). Although financial distress has been extensively investigated in the general corporate finance literature, empirical research focusing specifically on the hotel sector remains relatively limited (Metaxas & Romanopoulos, 2023), despite the sector's pronounced exposure to demand volatility, seasonality, and external shocks (Situm, 2023). Previous studies suggest that traditional accounting-based indicators can be complemented with additional financial signals and broader sources of information in the analysis of financial distress (Campbell et al., 2008; Shumway, 2001). In addition, research in the hotel sector emphasizes the importance of financial indicators adapted to the specificities of this industry in distinguishing financially vulnerable from financially stable companies, indicating the need to interpret the results of financial analysis in accordance with sectoral characteristics (Goh et al., 2022; Kim & Gu, 2006). Although cash flow-based indicators have attracted increasing attention in financial distress research in recent years (Seretidou et al., 2025), a substantial part of the empirical literature continues to rely primarily on traditional accounting-based indicators and individual groups of financial ratios (Altman, 1968; Beaver, 1966; Ohlson, 1980). Recent literature reviews indicate the need for broader and more integrated approaches to the analysis of financial distress, while relatively limited attention has been devoted to analytical frameworks that simultaneously capture multiple dimensions of financial performance (Seretidou et al., 2025). At the same time, recent research in tourism, hospitality and other service industries increasingly emphasizes

the importance of sector-specific approaches to the analysis of financial distress, especially in conditions of uncertainty and exposure to external shocks (Amara & Fadli, 2024; Crespi-Cladera et al., 2021; Situm, 2023). Against this backdrop, this research applies a multidimensional analytical framework that is not conceived as a single predictive or econometric model, but rather as an analytical approach aimed at providing a more comprehensive assessment of financial distress compared to traditional unidimensional approaches.

Starting from the limitations of traditional unidimensional approaches, this study develops the KRAS framework as an integrative analytical framework for a multidimensional assessment of financial distress in the hotel sector. The conceptual basis of the KRAS framework rests on the assumption that a company's financial vulnerability cannot be reliably assessed through a single dimension of operations but instead requires the simultaneous consideration of multiple complementary financial dimensions. To this end, it integrates four complementary dimensions: continuity, which reflects liquidity and cash flow sustainability; reputation, which encompasses profitability signals relevant to external stakeholders; activity, which indicates the efficiency of resource use; and structure, which reflects financial stability through capital structure and solvency. Each dimension is operationalized using two representative indicators, selected in accordance with the objective of the empirical analysis. Such an approach provides a balance between analytical comprehensiveness and interpretive clarity, while preserving the conceptual consistency of the KRAS framework. In this context, the KRAS framework is conceived as an integrative analytical framework for the multidimensional assessment of financial distress, rather than as a predictive scoring model. Given the above limitations, this study examines the relative importance of cash flow and accounting-based performance measures, applying a multidimensional analytical approach to financial distress in the hotel sector. A multidimensional perspective allows for a comparative and comprehensive view of multiple financial dimensions relevant to understanding financial distress. The study aims to identify the structural drivers of financial distress and to assess the extent to which different financial indicators distinguish financially stable companies from companies in financial distress. Recent literature increasingly emphasizes the importance of multidimensional analytical approaches that integrate different financial dimensions in the analysis of financial distress (Habib et al., 2020; Seretidou et al., 2025). Within the KRAS dimensions, the continuity and structure dimensions are expected to show greater discriminatory potential in Altman-defined financial distress zones than profitability indicators, which represent an operational measure of the reputation dimension. In this context, hypotheses are formulated through representative indicators of individual KRAS dimensions, as the basis for their empirical operationalization.

H₁: Indicators related to the continuity dimension, based on liquidity and cash flows, are expected to exhibit stronger differentiation across Altman-defined financial distress zones than profitability-based indicators.

H₂: Indicators related to the structure dimension are expected to exhibit stronger differentiation across Altman-defined financial distress zones than profitability-based indicators.

Hypotheses were formulated at the level of KRAS dimensions, while individual indicators were used as their representative operational measures in the empirical analysis. The following section reviews literature relevant to the hotel industry and multidimensional approaches to financial distress analysis.

2. Background

Sectors characterized by high operational volatility and sensitivity to external shocks are particularly exposed to financial distress. Financial distress is commonly associated with deteriorating liquidity, declining solvency, and an increased risk of insolvency (Campbell et al., 2008; Platt & Platt, 2002). Financial distress analysis is especially relevant in the hotel industry, where financial stability is shaped by seasonal demand patterns, macroeconomic fluctuations, and exposure to external shocks (Crespi-Cladera et al., 2021). Therefore, identifying key determinants that increase the sector's vulnerability to financial distress is a managerial priority. Classical financial distress models are primarily based on financial statement data operationalized through systems of financial ratios, including univariate, discriminant, and probabilistic approaches (Altman, 1968; Beaver, 1966; Ohlson, 1980). Among these approaches, Altman's Z-score family of models has become one of the most widely applied frameworks for assessing financial distress (Altman, 1968; Altman, 2005; Altman et al., 2017; Altman, 2018). Classical approaches primarily rely on profitability, leverage, and solvency indicators; however, exclusive reliance on accounting data may limit the ability of financial distress models to capture cash flow dynamics and rapidly changing financial conditions. Accordingly, traditional accounting ratios can be complemented with additional financial and market-based information (Campbell et al., 2008; Shumway, 2001). More recent evidence particularly highlights the growing relevance of liquidity- and cash-flow-based indicators in assessing financial vulnerability (Seretidou et al., 2025). This perspective is further supported by empirical studies emphasizing the relevance of liquidity indicators for evaluating financial performance and financial vulnerability across different sector-specific contexts (Čavlin et al., 2024; Milašinović et al., 2019; Prdić, 2023). Research indicates that liquidity, solvency, and long-term financial sustainability indicators play an important role in the early recognition of financial difficulties in the hotel sector, particularly during periods of economic stagnation and increased uncertainty (Pelaez-Verdet & Loscertales-Sanchez, 2021). At the same time, recent evidence suggests that assessing firms' financial conditions benefits from considering multiple financial dimensions, as individual indicators may not fully capture financial resilience and vulnerability under changing economic conditions (Tascón et al., 2024). The broader financial distress literature also recognizes the relevance of both financial and non-financial determinants (Habib et al., 2020). For example, corporate social responsibility has been identified as a non-financial factor associated with lower financial distress risk (Boubaker et al., 2020).

In this context, previous studies highlight the importance of including firm-specific factors, such as firm age and industry characteristics when interpreting financial performance (Obradović et al., 2019). Integrating traditional accounting and cash-flow-based indicators can strengthen the analytical assessment of financial performance and vulnerability (Seretidou et al., 2025), while in the hotel sector such assessment should also account for sector-specific financial determinants and operating characteristics (Metaxas & Romanopoulos, 2023). Previous studies in the hotel sector have largely focused on the applicability of financial distress prediction models, particularly those based on the Altman framework (Diakomihalis, 2012; Goh et al., 2022). The performance and interpretation of existing models can be affected by the specificities of the hotel sector, including the seasonal nature of the business, the volatility of demand, and the high capital intensity. Therefore, financial distress assessment in the hotel sector may benefit from sector-sensitive analytical approaches rather than from the direct application of models developed in different industrial settings (Kim, 2018; Romanopoulos & Metaxas, 2024). In the hotel sector, financial performance reflects the complex interaction of operational efficiency, financial management and exposure to external economic conditions, which justifies the application of integrated multidimensional analytical approaches. Previous studies emphasize the relevance of

operating and financial indicators, together with effective risk management in maintaining financial stability (Karanović et al., 2018; Kim & Gu, 2006). Profitability and operating performance remain important dimensions of hotel financial performance (Mitrović et al., 2021). However, evidence from the hospitality sector indicates that liquidity and financial structure become particularly relevant in explaining financial vulnerability, especially during periods of external disruption (Crespi-Cladera et al., 2021; Milašinović et al., 2019). Recent studies have reinforced the importance of sector-specific approaches to financial distress assessment in the hospitality industry (Amara & Fadli, 2024; Situm, 2023). Despite the growing interest in financial distress and its determinants in both the general and hospitality-specific literature (Habib et al., 2020; Metaxas & Romanopoulos, 2023), relatively few studies have integrated multiple dimensions of financial performance into a single analytical framework. In the hotel sector, existing studies predominantly focus on bankruptcy prediction models, default determinants, or individual groups of financial indicators rather than on integrated multidimensional analytical frameworks (Metaxas & Romanopoulos, 2023; Romanopoulos & Metaxas, 2024).

The existing research gap indicates the need to develop an integrated analytical approach that allows for a more comprehensive assessment and interpretation of financial distress. In response to this gap, this study developed the KRAS framework, a multidimensional analytical approach that integrates four dimensions of financial performance – continuity, reputation, activity, and financial structure – for a more comprehensive assessment of financial distress in the hotel sector. The focus of the analysis is on the extent to which these dimensions show different patterns across Altman-defined financial distress zones, thereby providing a methodological basis for the empirical testing of the proposed hypotheses.

3. Materials and methods

The data source for this study is the official database of the Business Registers Agency of the Republic of Serbia, based on publicly available financial statements of hotel corporations (Business Registers Agency of the Republic of Serbia, 2026), which forms the basis of the quantitative research design. The research sample consists of all 17 companies classified in sector 551 – Hotels and similar accommodation that are organized in the legal form of joint-stock company (JSC). Since, unlike other types of companies, joint-stock companies are subject to stricter financial reporting standards, the sample base for the empirical financial analysis represents the most transparent subset of the population. The analysis includes a six-year period from 2019 to 2024 and 17 joint-stock hotel corporations, resulting in 97 firm-year observations, with each observation representing one corporation in a given fiscal year. Each firm-year observation was treated as an independent analytical unit. Altman EMS values were calculated individually for each firm and each year, after which the observations were classified into distress, grey, and safe zones according to the standard EMS cut-off values. Following the classification procedure, non-parametric statistical analysis was conducted on the pooled firm-year observations across the entire study period in order to examine differences in KRAS indicators between Altman zones. Accordingly, the analysis focuses on differences between financial stability categories at the firm-year level rather than on longitudinal changes within individual firms. The analysis is conducted at the firm-year level, while aggregate statistics are used to present results across Altman-defined financial distress zones for comparative purposes. The panel is unbalanced, due to missing data for certain firms in individual years. Missing values are excluded using a pairwise deletion approach, whereby observations with incomplete data were excluded only from specific calculations involving unavailable inputs. Accordingly, all statistical analyses were conducted separately for each indicator using all available observations. Consequently, the effective sample size varies slightly across indicators and statistical tests, which should be

taken into account when interpreting individual statistical tests. The use of secondary financial statement data ensures the objectivity and comparability of empirical analysis (Saunders et al., 2019), while also supporting the transparency and repeatability of quantitative research procedures (Creswell & Creswell, 2017). Accordingly, depending on the availability of data for each variable, the number of observations (N) shown in the tables may vary. The empirical analysis is based on the KRAS framework developed in this study, which integrates four complementary dimensions of financial performance: continuity (K), reputation (R), activity (A) and structure (S). The operationalization of individual dimensions was performed on the basis of theoretically and analytically selected financial indicators derived from publicly available financial reports. In this study, the continuity dimension (K) is operationalized through indicators of operating performance, liquidity, and cash flow generation capacity, including the EBITDA margin and the ratio of operating cash flow to current liabilities. Cash-flow information provides additional insight into firms' financial flexibility and ability to meet obligations (DeFond & Hung, 2003; Seretidou et al., 2025). In this study, liquidity-related indicators reflect the ability of a corporation to settle short-term obligations in a timely manner and without difficulty, thereby maintaining cash flow stability, which is an important factor of financial flexibility. The dimension of reputation (R) is approximated by profitability indicators, such as return on assets (ROA) and return on sales (ROS), which reflect the ability to generate returns and signal financial performance to the market. In this study, the reputation dimension is interpreted in a financial-performance-related context, where profitability indicators are treated as observable signals of financial performance available to external stakeholders rather than as a broader perception-based or intangible concept of reputation. Accordingly, the R dimension within the KRAS framework is labeled "Reputation (financial-performance-related)". The activity dimension (A) includes operational efficiency indicators, such as asset turnover and receivables turnover. The structure dimension (S) is operationalized through the equity-to-assets ratio and the operating-cash-flow-to-total-liabilities ratio, capturing capital adequacy and cash-flow-based solvency, respectively (Altman, 1968; Beaver, 1966). In this way, the operational construct allows for a consistent mapping between conceptual dimensions and available financial indicators, forming a coherent basis for subsequent empirical analysis. Moreover, the sample includes all joint-stock enterprises in the sector, and covers a substantial share of the sector's economic activity, accounting for 7.08% of total revenues and 4.8% of total employment, which was calculated by the authors by comparing the aggregate values of the sample with the values at the sector level based on data from the Business Registers Agency of the Republic of Serbia. Table 1 presents the structure of the KRAS framework, including its dimensions, indicators, formulas, and data sources. To ensure comparability of results across companies and over the observed time period, all indicators are calculated based on standard financial statements and labeled as K1–K2, R1–R2, A1–A2 and S1–S2. These labels are used consistently throughout the analysis. Since the KRAS framework includes eight financial indicators distributed in four dimensions (continuity, reputation, activity and structure), the empirical analysis includes all eight indicators (K1–K2, R1–R2, A1–A2 and S1–S2). This enables a comprehensive assessment of the discriminatory ability of each dimension in differentiating companies according to Altman-defined financial distress zones. Although some indicators conceptually belong to the same dimension, each of them represents a different aspect of financial performance and is therefore analyzed individually. This approach enables a simultaneous overview of the conceptual structure of the KRAS framework and an empirical assessment of the relative contribution of each indicator in the identification of financial distress.

Accordingly, the indicators are not treated as reflective variables of a latent construct but as analytical measures representing distinct financial dimensions. In this study, financial distress is operationalized using the Altman Emerging Market Score (EMS) model, developed for emerging markets and economies in transition (Altman, 2005). Its application

is considered appropriate for the Serbian context because the model was developed for emerging-market settings and has previously been applied in Serbia and comparable environments (Altman, 2005; Altman et al., 2017; Milašinović et al., 2019). The EMS is calculated for each firm-year observation and is used as a classification criterion for grouping firms into three categories: the distress zone ($Z < 1.1$), the grey zone ($1.1 \leq Z \leq 2.6$), and the safe zone ($Z > 2.6$). The classification into zones serves as a proxy for different levels of financial distress risk. The Altman Emerging Market Score (EMS) is calculated as follows:

$$Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4,$$

where: X_1 = Working capital / Total assets, X_2 = Retained earnings / Total assets, X_3 = Earnings before interest and taxes (EBIT) / Total assets, X_4 = Book value of equity / Total liabilities

The classification thresholds (1.1 and 2.6) correspond to the standard cut-off values for the Altman Emerging Market Score model (Altman, 2005). The empirical analysis process was implemented through three phases: (1) descriptive analysis of financial performance and KRAS indicators, (2) classification of companies into Altman-defined zones, and (3) non-parametric testing of differences between groups. Although the KRAS framework and EMS are based on different indicators, both rely on financial statement data and reflect related dimensions of financial performance. Consequently, a degree of conceptual overlap between the KRAS indicators and the Altman EMS components is acknowledged; however, their roles in the analysis remain analytically distinct. In this study, EMS is used as a classification benchmark, while the KRAS framework serves as a multidimensional analytical tool for examining differences across distress zones.

Table 1: KRAS – multidimensional analytical framework

KRAS dimension	Code	Indicator	Formula	Data source
K – Business continuity	K1	EBITDA margin	EBITDA / Operating revenues	Income statement
	K2	OCF / Current liabilities	Operating cash flow / Current liabilities	Cash flow statement, Balance sheet
R – Reputation (financial-performance-related)	R1	ROA	Net profit / Total assets	Income statement, Balance sheet
	R2	ROS (net profit margin)	Net profit / Operating revenues	Income statement
A – Activity	A1	Total asset turnover	Operating revenues / Total assets	Income statement, Balance sheet
	A2	Receivables turnover	Operating revenues / Average receivables	Income statement, Balance sheet
S – Structure	S1	Equity / Total assets	Total equity / Total assets	Balance sheet
	S2	Dynamic solvency (OCF / liabilities)	Operating cash flow / Total liabilities	Cash flow statement, Balance sheet

Source: Authors' research

Descriptive analysis includes measures of central tendency (mean and median), dispersion (standard deviation), and range (minimum and maximum values), with median values reported as more robust indicators of central tendency in the presence of outliers and non-

normal distributions. The assumption of normality was tested using the Shapiro-Wilk test, and the results are presented in Table 2.

Table 2: Results of the Shapiro–Wilk normality test

Variable	N	W	p-value
K1	97	0.298	<0.001
K2	96	0.344	<0.001
R1	94	0.480	<0.001
R2	97	0.116	<0.001
A1	96	0.818	<0.001
A2	79	0.876	<0.001
S1	97	0.882	<0.001
S2	97	0.328	<0.001

Note: The Shapiro–Wilk test was used to assess the normality of each KRAS indicator. p-values lower than 0.05 indicate statistically significant deviations from the normal distribution. Consequently, non-parametric statistical methods were applied in the subsequent analyses.

Source: Authors' research

The results indicate statistically significant deviations from normality for all analyzed variables, supporting the application of non-parametric statistical methods in the subsequent stages of the analysis. Given deviations from normality, confirmed using the Shapiro–Wilk test and inspection of distributional characteristics, non-parametric methods are applied (Conover, 1999; Field, 2024), as they do not require the assumption of normal distribution and are more appropriate for analyzing differences between groups under such conditions. Differences in KRAS indicators across Altman-defined zones are assessed using the Kruskal–Wallis test (Kruskal & Wallis, 1952), while pairwise comparisons are conducted using the Mann–Whitney U test (Mann & Whitney, 1947) as a post-hoc procedure. Accordingly, the applied non-parametric tests are used to identify statistically significant differences between groups, rather than to assess causal relationships or the explanatory power of individual indicators. Effect sizes were evaluated using epsilon squared (η^2), where values below 0.01 indicate negligible effects, values between 0.01 and 0.06 indicate small effects, values between 0.06 and 0.14 indicate moderate effects, and values above 0.14 indicate large effects (Tomczak & Tomczak, 2014). Therefore, the application of non-parametric methods in combination with effect size analysis provides a methodologically consistent basis for empirical analysis and testing of the hypotheses presented in the following section (Tomczak & Tomczak, 2014).

4. Results and discussion

4.1. Sector overview and sample characteristics

Sector 551 – Hotels and similar accommodation represents a significant segment of the service industry in the Republic of Serbia. Financial data were obtained from publicly available financial reports (Business Registers Agency of the Republic of Serbia, 2026). In 2024, this sector accounted for 22.9% of the total revenues of Sector I – Accommodation and food services, which indicates its economic relevance and important role in the structure of the service economy. The structure of the sector by legal form indicates the dominance of limited liability companies (70.49%), while entrepreneurs make up 27.29% of the total number of entities. Joint-stock companies make up only 1.71%, which indicates their relatively low representation in the population, despite their significant economic potential. The sample includes 17 companies organized as joint stock companies, thus focusing the

analysis on formally organized and more financially transparent entities with available financial reports. These companies generate 7.08% of total revenues and employ 4.8% of employees in sector 551, indicating their significant economic presence. The analyzed companies are unevenly geographically distributed across the Republic of Serbia, with the largest share concentrated in the City of Belgrade (29.41%), followed by key tourist regions, including Zlatibor, South Bačka and Srem districts (17.65%), while other regions have a lower presence. In the sample, according to the size criterion, micro (43.75%) and small enterprises (37.50%) predominate, while medium-sized enterprises account for 18.75%.

4.2. Descriptive statistics of the sample

Insight into the current financial performance of joint-stock hotel companies is provided by a descriptive statistical analysis based on data from the last available accounting year (2024).

Table 3: Financial characteristics of the sample (2024)

Variable	Mean	Median	Std.Dev.	Min	Max
Operating revenue	316,804.71	83,192.50	668,822.80	0.00	2,264,927.00
Total assets	826,287.71	244,732.50	1,626,942.76	0.00	5,933,338.00
Net profit	86,621.71	1,055.00	263,134.31	-43,307.00	925,481.00
Employees	37.41	21.00	61.90	0.00	226.00

Note: Negative values of net profit indicate loss. All values are expressed in thousand RSD.

Source: Authors' research

Table 3 presents the key financial characteristics of the sample, while Table 4 summarizes the distribution of the KRAS indicators. The results presented in Table 3 indicate a pronounced heterogeneity among the analyzed companies, which is reflected in significant differences in operating revenue and total assets. At the same time, the presence of both profitable and loss-making companies indicates uneven financial performance within the sample. Variations in the number of employees further reflect differences in organizational size and operational scope, supporting the characterization of the sector as fragmented. Table 4 presents descriptive statistics of the KRAS indicators, including measures of central tendency, dispersion and range. The results indicate significant variability of all indicators, especially within the structure dimension, indicating significant differences in the financial positions of companies. The differences between the mean and median values indicate the asymmetric distribution and the presence of outliers, which further justifies the application of non-parametric methods in the subsequent analysis.

Table 4: Descriptive statistics of KRAS indicators

Indicator	Mean	Median	Std.Dev.	Min	Max
K1	0.025	0.120	0.488	-1.302	0.633
K2	-4.279	0.104	17.496	-67.419	2.011
R1	0.028	0.004	0.056	0.000	0.165
R2	0.105	0.011	0.171	0.000	0.533
A1	0.318	0.231	0.330	0.000	1.002
A2	23.277	13.461	23.483	1.478	77.900
S1	0.626	0.779	0.338	0.000	0.997
S2	-4.436	0.073	17.445	-67.419	1.843

Note: Descriptive statistics are calculated for the year 2024. Due to non-normal distribution and the presence of outliers, median values are used in subsequent analysis.

Source: Authors' research

In general, the findings of the descriptive analysis indicate that the analyzed sample of joint-stock hotel companies is characterized by considerable heterogeneity and uneven financial performance, which provides a relevant empirical basis for further analysis of the determinants of financial difficulties, without implying a full generalization of the findings to the entire hotel sector.

4.3. Distribution across Altman-defined financial distress zones

Table 5 shows the distribution of companies by Altman zones, which indicates a predominantly stable structure of the analyzed sector. Approximately 72% of observations are classified in the safe zone, about 19% in the financial distress zone, while approximately 9% belong to the grey zone. These results indicate that the majority of joint-stock hotel companies operate in financially stable conditions, although a smaller part is exposed to financial distress. The presence of a relatively small share of companies in the gray zone indicates a limited transition dynamic between financial stability and financial distress, with a clear demarcation between stable and financially vulnerable entities. At the same time, the dynamics of the Z-score values show an upward trend of the median values in recent years, which indicates a general improvement in financial stability within the analyzed sample. However, the persistence of low values in the first quartile indicates that a segment of companies continues to operate under increased financial risk. Overall, the results point to improving aggregate financial stability, accompanied by pronounced heterogeneity within the sector. The pattern constructed in this way requires analysis within the KRAS framework in order to address the following question: do financial performance indicators systematically differ in different zones of financial distress?

Table 5: Distribution of firms across Altman-defined zones and Z-score statistics (2019–2024)

Year	Distress (%)	Grey (%)	Safe (%)	Median Z-score	P25	P75	N
2019	17.65%	5.88%	76.47%	4.12	2.98	12.91	17
2020	17.65%	11.76%	70.59%	4.00	2.61	8.17	17
2021	18.75%	18.75%	62.50%	3.59	2.01	3.59	16
2022	17.65%	5.88%	76.47%	5.98	3.49	7.05	17
2023	20.00%	6.67%	73.33%	7.18	3.10	15.33	15
2024	20.00%	6.67%	73.33%	6.98	2.80	12.95	15
Total	18.56%	9.28%	72.16%	4.65	2.44	13.25	97

Note: Z-score values are calculated according to the Altman EMS model. Firms are classified into three zones: distress ($Z < 1.1$), grey ($1.1 \leq Z \leq 2.6$), and safe ($Z > 2.6$). P25 and P75 denote the 25th and 75th percentiles, respectively.

Source: Authors' research

4.4. Relationship between KRAS indicators and financial distress

Descriptive statistics provide an initial overview of the differences in KRAS indicators across Altman-defined zones while preserving the multidimensional structure of the KRAS framework. Table 6 shows the distribution of indicator values across Altman-defined zones, which forms the basis for analyzing the relationship between KRAS indicators and financial distress. In this way, a starting point for the analysis and systematic identification of

differences between the financial stability zone and different dimensions of financial performance is established.

Descriptive analysis shows that indicators of the structure dimension (S1 and S2) show the most pronounced differences across Altman-defined financial distress zones, whereby companies in the safe zone generally show higher values than companies in the financial distress zone. At the same time, indicators of continuity (K1 and K2) and activity (A1 and A2) show certain differences between zones, while indicators of profitability (R1 and R2) do not show a clear pattern of separation.

Observed by dimensions, the indicators of structure show the most stable differences between zones of financial distress, while the indicators of continuity and activity indicate moderate differences. In contrast, profitability indicators show much smaller differences between the observed groups. However, since descriptive analysis alone does not allow for the assessment of the statistical significance of the observed differences, non-parametric tests are applied in the following analysis for their formal verification.

Table 6: Median values of KRAS indicators by Altman-defined financial distress zones

Year	Altman zone	K1	K2	R1	R2	A1	A2	S1	S2	Nz
2019	Distress	-0.39	0.35	0.00	0.00	0.21	9.20	0.00	0.33	3
	Grey	0.22	1.15	0.05	0.10	0.48	24.21	0.85	0.98	1
	Safe	0.04	2.43	0.00	0.00	0.23	29.64	0.77	1.20	13
2020	Distress	-0.75	0.77	0.00	0.00	0.17	16.96	0.49	0.32	3
	Grey	-0.12	1.33	0.00	0.00	0.25	19.21	0.38	1.20	2
	Safe	-0.11	1.76	0.00	0.00	0.10	16.41	0.81	1.23	12
2021	Distress	-0.89	0.01	0.00	0.00	0.02	10.45	0.00	0.01	3
	Grey	-0.02	0.17	0.00	0.00	0.25	22.38	0.43	0.07	3
	Safe	0.12	0.32	0.00	0.00	0.17	17.62	0.79	0.16	10
2022	Distress	-1.19	-0.01	0.00	0.00	0.03	8.58	0.00	-0.01	3
	Grey	0.08	0.34	0.01	0.02	0.74	69.64	0.43	0.07	1
	Safe	0.14	0.15	0.02	0.05	0.22	18.42	0.75	0.15	13
2023	Distress	-0.16	0.00	0.36	0.00	0.08	9.78	0.00	0.00	3
	Grey	0.09	0.45	0.04	0.02	0.89	55.71	0.46	0.08	1
	Safe	0.17	0.33	0.02	0.04	0.29	14.04	0.84	0.16	11
2024	Distress	-0.37	-0.24	0.00	0.00	0.04	9.33	0.00	-0.23	3
	Grey	0.04	0.67	0.00	0.00	0.94	49.09	0.45	0.14	1
	Safe	0.21	0.29	0.01	0.05	0.29	12.01	0.80	0.19	11

Note: Median values are reported for each Altman zone.

Source: Authors' research

4.5. Statistical analysis

After the descriptive analysis presented in Table 6, the statistical significance of the differences across Altman-defined financial distress zones was assessed using the Kruskal–Wallis test for all eight KRAS indicators. The results are shown in Table 7.

Table 7: Kruskal–Wallis test results and effect sizes for KRAS indicators

Code – Dimension	H	df	p-value	η^2	Effect size	Interpretation
K1 - Continuity	6.80	2	0.033	0.051	Small	Statistically significant
K2 - Continuity	6.97	2	0.031	0.053	Small	Statistically significant
R1 - Reputation	0.56	2	0.756	0.000	Negligible	Not statistically significant
R2 - Reputation	1.47	2	0.480	0.000	Negligible	Not statistically significant
A1 – Activity	7.47	2	0.024	0.059	Small	Statistically significant
A2 – Activity	7.58	2	0.022	0.073	Moderate	Statistically significant
S1 - Structure	50.22	2	<0.001	0.513	Large	Highly statistically significant
S2 - Structure	5.96	2	0.051	0.042	Small	Marginally significant (borderline)

Note: The Kruskal–Wallis test was used to assess differences among Altman Z zones. Effect size was calculated using epsilon squared (η^2). According to conventional guidelines, η^2 values below 0.01 indicate negligible effects, values between 0.01 and 0.06 indicate small effects, values between 0.06 and 0.14 indicate moderate effects, and values above 0.14 indicate large effects.

Source: Authors' research

The results of the Kruskal–Wallis test show that statistically significant differences between Altman-defined zones exist for five of the eight KRAS indicators analyzed. The most pronounced discriminatory ability was observed for the structure indicator S1, which achieves a very large effect ($\eta^2 = 0.513$), while S2 is of borderline statistical significance with a small effect. Continuity indicators (K1 and K2) show statistically significant differences between zones, but with small effects. Similarly, the activity indicators (A1 and A2) also distinguish Altman zones, with A2 having a moderate effect, while A1 shows a small effect. In contrast, profitability indicators (R1 and R2) do not show statistically significant differences between the observed groups.

Across KRAS dimensions, the results confirm the dominant role of the structure dimension in differentiating financially stable and financially vulnerable companies. The dimensions of continuity and activity show statistically significant, but significantly smaller effects, while the reputation dimension, operationalized through profitability indicators, does not contribute significantly to the differentiation between Altman-defined zones.

To examine which zones differ in greater detail, a post hoc analysis was conducted using the Mann–Whitney U test with Bonferroni correction. The results are shown in Table 8.

Post hoc analysis confirms that the most pronounced differences are present in the structure indicators. The S1 indicator shows statistically significant differences between all pairs of Altman zones, which confirms its exceptional discriminatory ability. Indicator A2 shows a significant difference between companies in the financial distress zone and the gray zone, while for the other indicators after the Bonferroni correction, no statistically significant pairwise differences were identified. These results confirm that indicators of the structure dimension are the most reliable indicators of financial distress. The dimensions of continuity and activity provide an additional, but significantly weaker discriminatory ability, while the reputation dimension, operationalized through profitability indicators, does not show a statistically significant discriminatory ability.

Table 8: Median values of KRAS indicators across Altman-defined zones and pairwise comparisons (Bonferroni-adjusted)

Indicator	Distress (Median)	Grey (Median)	Safe (Median)	KW p-value	η^2	Significant pairwise comparisons
K1 – Continuity	-0.38	0.08	0.10	0.033	0.051	No significant pairwise differences
K2 – Continuity	0.025	0.34	0.62	0.031	0.053	No significant pairwise differences
R1 – Reputation	0.00	0.00	0.00	0.756	0.000	No significant pairwise differences
R2 – Reputation	0.00	0.00	0.00	0.480	0.000	No significant pairwise differences
A1 – Activity	0.04	0.48	0.215	0.024	0.059	No significant pairwise differences
A2 – Activity	11.56	24.21	16.23	0.022	0.073	Distress vs Grey
S1 – Structure	0.00	0.46	0.795	<0.001	0.513	Distress vs Grey; Distress vs Safe; Grey vs Safe
S2 – Structure	0.005	0.09	0.325	0.051	0.042	No significant pairwise differences

Note: Median values are reported because the variables were not normally distributed and are presented with up to three decimal places where necessary. Overall differences among Altman Z zones were assessed using the Kruskal–Wallis test. Pairwise comparisons were performed using the Mann–Whitney U test with Bonferroni adjustment for multiple comparisons (adjusted significance level $\alpha = 0.0167$). Effect size is reported as epsilon squared (η^2).

Source: Authors' research

4.6. Discussion

Empirical results show that financial distress in the sample of hotel joint-stock companies is most strongly related to the structure dimension, which shows the highest and most consistent discriminatory ability between Altman-defined financial distress zones. The dimensions of continuity and activity also contribute to distinguishing financially stable and financially vulnerable companies, but with significantly smaller effects, while the reputation dimension, operationalized through profitability indicators, did not show statistically significant differences between the observed groups. Within the KRAS framework, the continuity dimension provides additional information on financial distress, but its discriminatory ability is significantly weaker compared to the structure dimension. The obtained results confirm that the indicators of the structure dimension, especially S1, appear to be the most informative indicators for distinguishing between financially stable and financially vulnerable companies, while the dimensions of continuity and activity have additional but substantially lower analytical value.

These findings are consistent with previous research emphasizing the relevance of liquidity and cash-flow information in assessing financial vulnerability (Čavlin et al., 2024; DeFond & Hung, 2003). The dominant role of S1 is also consistent with the established importance of capital structure and solvency indicators in financial distress assessment (Altman, 1968; Beaver et al., 2011). This pattern suggests that structural financial stability has greater analytical relevance in the analyzed sample than short-term profitability performance.

The findings also support previous research indicating that traditional accounting ratios can be complemented with additional market-based and dynamic financial information when assessing financial distress (Campbell et al., 2008; Shumway, 2001). The KRAS framework extends this logic by jointly examining several complementary dimensions of financial performance.

The results are also consistent with sector-specific evidence showing that financial distress in hospitality firms is shaped by the industry's specific financial and operating characteristics (Situm, 2023). The importance of financial vulnerability becomes especially visible during major external disruptions, as demonstrated by research on the effects of the COVID-19 crisis on hospitality firms (Crespi-Cladera et al., 2021). Recent studies further demonstrate the continued use of financial-indicator-based models in hospitality financial distress assessment and the relevance of sector-specific conditions when interpreting their results (Matejić et al., 2022; Septiani & Arifah, 2026).

Overall, the findings indicate that financial distress in the analyzed sample of hotel joint-stock companies is not equally associated with all dimensions of the KRAS framework. Empirical analysis shows that the structure dimension achieves by far the greatest discriminatory ability between Altman-defined financial distress zones, with the S1 indicator being the most stable and statistically significant indicator in the entire model. At the same time, S2 shows a descriptively consistent pattern, but its overall difference across zones remains marginal and does not reach the conventional 5% significance threshold. In contrast, the continuity dimension shows statistically significant differences between Altman-defined zones, but with small effects, indicating that this dimension has additional, but limited, discriminatory ability. Similarly, the activity indicators also provide additional discriminatory information for distinguishing financially stable and financially vulnerable companies, with indicator A2 having a moderate effect, while A1 shows a small effect. Such results indicate that indicators of activity can represent a useful supplement to the assessment of financial distress, but they are not dominant carriers of information.

Unlike the dimensions of continuity, activity and structure, the dimension of reputation, operationalized through profitability indicators (R1 and R2), did not show a statistically significant ability to differentiate Altman zones. This finding indicates that profitability indicators, observed within the reputation dimension, have limited analytical value in distinguishing financially stable and vulnerable hotel companies. At the same time, the results indicate that, in the analyzed sample, financial stability is more strongly associated with capital structure and solvency than with short-term profitability changes.

These results further confirm the conceptual validity of the KRAS framework, whose analytical value is manifested through the integration of complementary dimensions of financial position and their joint, rather than isolated, interpretation. Simultaneous consideration of the dimensions of continuity, reputation, activity and structure allows for a more comprehensive interpretation of financial vulnerability than relying on individual financial indicators. In this sense, the contribution of the KRAS framework does not stem from the assumption that all dimensions are equally informative, but from the ability to identify their different, but mutually complementary analytical value.

From a managerial perspective, the results obtained indicate that capital structure, solvency and long-term financial stability should be given special attention when assessing the financial vulnerability of hotel companies. At the same time, continuity indicators can provide early warning signals of liquidity problems and cash flow pressures, while activity indicators contribute to the assessment of the efficiency of the use of available resources. In this sense, the results indicate that the KRAS framework can be a useful analytical tool for

managers, investors, creditors, and other users of financial statements when assessing the financial vulnerability and risk profile of hotel companies.

The results provide partial empirical support for hypothesis H1, while hypothesis H2 received stronger empirical support than H1. Although the continuity indicators enabled the differentiation of Altman zones at the aggregate level, their differentiation ability remained limited, as confirmed by the small effect sizes and the absence of statistically significant pairwise differences after Bonferroni adjustment. In contrast, the structure dimension, and especially the S1 indicator, showed the most pronounced and consistent ability to differentiate zones of financial distress. On the other hand, the reputation dimension, operationalized through profitability indicators, did not show a statistically significant differentiation ability.

These results should be interpreted in the context of the characteristics of the analyzed sample and the specificity of the hotel sector. Although the results confirm the analytical potential of the KRAS framework, its applicability and generalizability require further empirical verification in different sectoral and institutional settings.

Future research should be directed towards external validation of the KRAS framework on samples from different economic sectors and national economies, in order to examine its validity, robustness, and generalizability, as well as its analytical applicability in different institutional and market settings. It would be especially useful to examine the performance of the KRAS framework at different stages of the business cycle and under different macroeconomic and institutional characteristics.

An additional methodological limitation concerns the treatment of firm-year observations as independent analytical units. Although this approach enabled the inclusion of all available observations during the 2019-2024 period, it does not fully take into account the longitudinal nature of the data and the potential within-firm dependence among repeated observations originating from the same company over several years. Therefore, the identified differences between Altman-defined financial distress zones should primarily be viewed as differences between firm-year observations, and not exclusively between independent companies.

In this sense, future research could apply longitudinal or panel methods that explicitly take into account the time dependence of observations, which would enable an additional check of the robustness of the obtained results and further development of the proposed KRAS framework.

5. Conclusion

The findings confirm that the application of the multidimensional KRAS framework enables a more comprehensive interpretation of financial distress compared to an analysis based solely on individual financial indicators. In the analyzed sample of hotel joint-stock companies, it was shown that the different dimensions of the KRAS framework do not have equal importance in distinguishing Altman-defined financial distress zones.

Empirical analysis shows that the structure dimension has the highest and most consistent discriminatory ability between Altman-defined financial distress zones. The dimensions of continuity and activity also show statistically significant differences between the observed groups, but with significantly smaller effects, while the reputation dimension, operationalized through profitability indicators, did not show a statistically significant discriminatory ability.

The scientific contribution of this study lies in showing that integrating the dimensions of continuity, reputation, activity and structure within the proposed KRAS framework enables a more comprehensive assessment of financial distress than approaches based on isolated analysis of individual financial indicators.

Overall, the findings indicate that the KRAS framework represents a relevant multidimensional analytical framework for assessing financial distress in the hotel sector. At the same time, the obtained findings are in line with previous research that emphasizes the importance of financial structure, solvency, and long-term financial stability in explaining financial distress, especially in conditions of increased uncertainty and pronounced business volatility. In addition, the research supports the use of non-parametric methods in the analysis of financial data that deviate from the normal distribution. The results have practical significance for managers, investors and creditors when assessing the financial vulnerability of hotel companies. In this regard, the structure dimension provides information of the greatest analytical importance, while the continuity and activity dimensions provide complementary information that contributes to a more comprehensive assessment of financial stability.

The results should, however, be interpreted with an appropriate degree of caution, given the relatively limited sample size and the specificities of the hotel sector, which may limit the generalizability of the results.

Future research should be extended to larger samples, different national economies, and other economic sectors in order to further examine the validity, robustness and generalizability of the KRAS framework.

CRedit author statement

Miroslav Čavlin: Conceptualization, Methodology, Formal analysis, Investigation, Validation, Writing – review & editing, Supervision. **Sanja Pešić:** Writing – original draft, Visualization, Software, Formal analysis. **Mirko Pešić:** Data curation, Investigation, Formal analysis.

Declaration of generative AI in the writing process

During the preparation of this work the authors did not use generative AI and AI-assisted technologies in the writing process. The declaration does not apply to the use of basic tools, such as tools used to check grammar, spelling and references.

Conflict of interest

The authors declare no conflict of interest.

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