ANALYSIS OF THE POSSIBILITY OF BANKRUPTCY IN MEDIUM-SIZED AGRIBUSINESS COMPANIES IN AP VOJVODINA

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A B S T R A C T

In the context of a volatile economy marked by diverse global crises, it becomes imperative to proactively assess the potential insolvency among economic entities. This study focuses on medium-sized companies involved in agricultural and food production within the AP Vojvodina, spanning the time frame from 2018 to 2022. The primary objective is to assess the likelihood of bankruptcy within the observed companies, applying Altman's modified Z score (Z'), Kralicek Quick test and the Springate model. The data utilized for this research are sourced from the financial reports of the observed companies. Based on the performed analysis, it can be concluded that the modified Altman's Z' score and the Springate model in most cases gave identical results on the occurrence of bankruptcy. Using the Kralicek Quick test, the solvency ratings are quite divergent. In the observed period, the possibility of bankruptcy was higher for agricultural companies compared to ones from the food industry.

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Introduction

Agribusiness is defined as the economic undertaking of agricultural holdings or entities engaged in the production and/or processing of raw agricultural commodities, culminating in the creation of final products for subsequent distribution. The observed activity also includes all economic activities that support agricultural production and conversion of raw materials (Katchova and Enlov, 2013). Agricultural production is traditionally a very significant economic activity in the Republic of Serbia, which is a consequence of relatively favorable agroecological conditions, as well as historical and developmental circumstances (Jakšić, et al., 2015). Notably, approximately 45% of the total utilized agricultural land within the country is situated in the territory of AP Vojvodina, as per data from the Statistical Office of the Republic of Serbia (2018). In the domain of sector A - Agriculture, companies in Vojvodina are predominantly structured as micro and small entities. However, the pivotal impact on the augmentation, evolution, and sustainability of agricultural production emanates from medium and large enterprises. These entities, contributing to over one-third of the total turnover in this sector, employ approximately 60% of the workforce within the agricultural domain (Kalas et al., 2017). Within the life cycle of a company, periods of both positive (successful) and negative (unsuccessful) trajectories transpire. When the negative phase evolves from a transient state to a structural and chronic disposition, persisting over time, the enterprise often confronts an impending fate of bankruptcy (Altman et al., 2013). Assessing the possibility of bankruptcy in market conditions is imperative for sustainable financial management. Bankruptcy can be defined as the incapacity of a company to fulfill due obligations, stemming from either present or past operational activities. This phenomenon not only detrimentally impacts the company itself but also extends its repercussions to other economic entities with whom it maintains direct or indirect collaborations (Bordeianu et al., 2011). Analysis of financial reports and the assessment of financial ratios offer valuable insights into the operational stability of a business. The basic premise is that if the observed enterprise achieves high marks in the financial analysis, there is less chance of bankruptcy. Bernhardsen (2001) states that conventional ratio indicators confront limitations due to the disparate properties in various economic sectors. The author advocates for the contextual evaluation of these relationships, incorporating additional information about the companies themselves and the markets in which they operate. Although traditional ratio indicators are still used today as a supplementary tool for assessing the possibility of bankruptcy, their use in the observed domain is more common in the creation of statistical models that assess financial position or the probability of bankruptcy. The latter half of the preceding century witnessed the inception of the first statistical models for bankruptcy assessment, initially grounded in discriminant analysis, linear probability, and logit/probit analysis. The escalating interest in the domain of bankruptcy prediction prompted extensive exploration by numerous scholars, resulting in the formulation of diverse models. Noteworthy among these are models stemming from the research efforts of William H. Beawer, Edward I. Altman, Edward B. Deakin, James A. Ohlson, Robert O.

Edmister, Christine V. Zavgren, and Peter Kralicek (Zenzerović et al., 2006). Aligned with the aforementioned considerations, this paper centers its research on medium-sized companies involved in agricultural and food production within the AP Vojvodina region during the period spanning 2018 to 2022. The primary objective of this research is to analyze the potential bankruptcy among the designated economic entities, applying Altman's modified Z score (Z'), the Kralicek quick test and the Springate model.

Literature review

Various scholars have engaged in the evaluation of financial positions and the analysis of bankruptcy likelihood within agricultural enterprises and entities in the food industry. Cîrciumaru (2011) applied Altman's Z score, Conan and Holder, Ohlson, Anghel and Circiumaru model to assess bankruptcy possibilities for 11 companies in the food industry operating in Romania from 2007 to 2009. The study concluded that general models were more appropriate for assessing bankruptcy likelihood in the observed case. Rajin et al. (2016) conducted a bankruptcy risk analysis for 5 agricultural companies in the Republic of Serbia from 2010 to 2013, utilizing Altman's modified Z' score, Kralicek DF indicator and Kralicek quick test. The results of this research point to more rigorous assessments of the possibility of bankruptcy using Altman's model. Vukadinović et al. (2018) also assessed the financial position of agricultural companies in the Republic of Serbia from 2014 to 2016, applying the modified Altman's Z' score, Kralicek Quick test and moderate growth model. The authors concluded that the applied models gave similar results and that there is a high risk of bankruptcy in the observed companies. Kovács et al. (2020) reached comparable conclusions in their research but used the modified Altman Z' score, Springate, Comerford and Fulmer method. The observed agricultural enterprises operated on the territory of Hungary in the period from 2014 to 2018. An assessment of the possibility of bankruptcy of mill companies in the territory of AP Vojvodina was presented in the research conducted by Tekić et al. (2020). The paper evaluated 5 economic entities that operated in the period from 2015 to 2019. Using Altman's Z score and Kralicek Quick test, the authors concluded that both models gave similar results when assessing the likelihood of bankruptcy. The application of specially created models for assessing the possibility of bankruptcy in Slovak agriculture (G and CH index) is presented in the research of Bencová et al. (2021). The authors presented an analysis of the financial position of Slovak farms for the period from 2009 to 2020. Also, general models were used in the paper: modified Altman Z' score, IN 05, Creditworthiness index and Taffler model. The research results showed that Altman's modified Z' score and G index gave more rigorous ratings of bankruptcy than other models. Milić et al. (2021) also concluded that Altman's Z' evaluated the possibility of bankruptcy more rigorously compared to other models. Using Altman's modified Z' score, the Kralicek DF indicator and the Kralicek Quick test, the authors analyzed the likelihood of bankruptcy occurrance in large agribusiness companies on the territory of AP Vojvodina in the period from 2015 to 2019. Stoyancheva et al. (2023) assessed financial viability and bankruptcy risk in Bulgarian agricultural enterprises from 2017 to 2021, using Altman's Z score,

Springate, IN05, and Zmijewski model with Springate, Altman and IN05 offering the most rigorous evaluations. Angelova et al. (2023) also supported the adequacy of the Springate model and Altman's Z score in assessing bankruptcy possibilities, analyzing 34 agricultural companies engaged in animal husbandry in Bulgaria from 2017 to 2021.

Materials and methods

The study focuses on assessing the likelihood of bankruptcy among economic entities involved in agricultural and food production within the AP Vojvodina region. Five agricultural companies, namely Agros (A), Best Seed Producer (B), Libela produkt (C), PIK Juzni Banat (D) and Vrebalov Agrar (E), were analyzed. Also, in research will be shown an evaluation of bankruptcy occurrence in five business entities from the food sector: Biospringer RS (F), Kristal So (G), Master Fruits (H), BB Minaqua (I) and Superior Foods (J). All the tested companies are legally structured as limited liability companies (l.l.c). Data spanning the period from 2018 to 2022 were sourced from the Serbian Business Registers Agency (SBRA) website, specifically from financial reports.

The following models will be used to analyze the possibility of bankruptcy:

Altman's modified Z score (Z')

The application of discriminant analysis within bankruptcy assessment models was pioneered by Edward I. Altman in 1968. Drawing insights from the financial performance of 66 manufacturing companies (half of which faced bankruptcy while the other half demonstrated sound solvency), he formulated a model specifically made for evaluating the financial health of entities with publicly traded shares. Among the 22 financial indicators analyzed, Altman identified and incorporated 5 key variables into the final Z score model (Altman, 1968). Recognizing the limitation of the initial model in appraising manufacturing companies absent from stock exchange listings, Altman subsequently redefined his formula in 1983 (Altman, 1983) as follows:

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$

Indicators in the discrimination function were calculated according to:

Z' = Z' score

X_1 = (current assets-current liabilities) / total assets

X_2 = retained earnings / total assets

X_3 = earnings before interest and taxes / total assets

X_4 = book value equity / total liabilities

X_5 = sales / total assets

Based on the obtained result, companies are classified into 3 zones: safe (Z'>2.9), gray (potential risk of bankruptcy; 1.23<Z'<2.9) and distressed zone (Z'<1.23).

Kralicek Quick test

The Kralicek Quick test was developed in 1990 and provides an opportunity for a quick assessment of the company's solvency. This model is based on the calculation of four indicators, two indicators of financial stability and two indicators of profitability (Didenko et al, 2012). The derived values of these model components dictate the allocation of points on a scale ranging from 1 to 5. Firms manifesting robust financial health garner 1 or 2 points, while the threshold between favorable and unfavorable financial positions is demarcated by 3 points. A score of 4 points designates a suboptimal financial state, and 5 points indicates a heightened risk of insolvency or bankruptcy (Kubenka, 2016). The final results are obtained as an average of previously calculated averages of indicator values, expressed in points (table 1).

Table 1. Kralicek Quick test methodology

Indicators	Points and grades				
	1 Excellent	2 Very good	3 Good	4 Bad	5 Risk of Insolvency
X_1	>0.3	0.2-0.3	0.1-0.2	0.0-0.1	Negative
X_2	<3	3-5	5-12	12-30	>30
Financial stability S1 = $(X_1+ X_2)/2$					
X_3	>0.15	0.12-0.15	0.08-0.12	0.0-0.08	Negative
X_4	>0.1	0.08-0.1	0.05-0.08	0.0-0.05	Negative
Total performance and profitability S2 = $(X_3+ X_4)/2$					
Total rating T= $[(X_1+ X_2)/2+(X_3+ X_4)/2]/2$					

Source: Kralicek (2007), adapted by the authors

The indicators used in this model were calculated according to:

X_1 = equity / total assets

X_2 = total liabilities-cash / net profit + depreciation

X_3 = earnings before interest and taxes / total assets

X_4 = net profit + depreciation / business revenue

Indicator X_1 denotes the self-participation within the aggregate sources of financing. As delineated by the predefined critical thresholds outlined in Table 2, this indicator is deemed satisfactory when attaining a value of 10% or higher. The period of debt repayment is shown by X_2, where the risk of insolvency arises with the value of the indicator greater than 30 years. It is advisable to maintain the observed indicator below 12 years. A negative value of the profitability of total assets indicator (X_3) signals solvency challenges, with a recommendation for values exceeding 8%. The share of cash flow in business income is represented by X_4. The observed indicator should have a value of 5% or greater.

Springate model

Gordon L.V. Springate modified Altman's Z score to align with the Canadian economy. Out of the 19 observed variables, a subset of 4 was strategically incorporated into the ultimate model designed for evaluating the potential of bankruptcy. Remarkably, the model demonstrated a 92.5% accuracy in forecasting bankruptcy (Springate, 1978):

$$S = 1.03X_1 + 3.072X_2 + 0.66X_3 + 0.4X_4$$

Indicators in the discrimination function were calculated according to:

S = S score

X_1 = (current assets-current liabilities) / total assets

X_2 = earnings before interest and taxes / equity

X_3 = earnings before taxes / current liabilities

X_4 = sales / total assets

Based on the obtained result, companies are classified as healthy (without risk of bankruptcy, S > 0.862) or endangered (high risk of bankruptcy, S < 0.862).

The economy in the Republic of Serbia markedly differs from the countries for which the analyzed bankruptcy prediction models were originally formulated (USA; Canada; Germany, Switzerland, and Austria). Some scholars (Platt and Platt (1990), Opler and Titman (1994), Maksimović and Phillips (1998), Grice and Dugan (2001), Niemann et al. (2008), Wu et al. (2010), Alihodžić (2013)) believe that the effects of industry should also be included in models for predicting bankruptcy. Karas et al. (2017) state that agricultural activity is specific, especially to other production activities (for which the observed models were primarily formed). However, given the dynamics in the economy, instances in the literature advocate for the appropriateness of utilizing general models for bankruptcy prediction (Cîrciumaru, 2011; Khorasgani, 2011; Zarei et al., 2012; Bencová et al., 2021). These "universal models" demonstrate efficacy contingent upon the economic conditions in the regions where businesses operate, along with the reliability of the financial data used in the applied models (Sušický, 2011).

Results and discussion

The collected data underwent an initial assessment using Altman's Z' score model to ascertain the potential for bankruptcy within the observed economic entities. The computed values of the modified Z' score for agricultural enterprises are presented below (table 2).

Table 2. Values of Z' indicators for observed agricultural companies

Company	Values of Z' indicator				
	2018	**2019**	**2020**	**2021**	**2022**
A	1.655	1.537	1.962	2.404	2.936
B	0.850	1.462	1.533	1.666	1.094
C	3.151	1.562	2.052	3.688	3.119
D	1.668	1.449	1.258	0.883	0.779
E	1.772	1.488	1.480	1.905	2.308

Source: Authors' calculations based on data from financial reports, Business Register Agency

Based on the established criteria outlined in Table 2, company A's operations primarily fall within the gray zone, indicating an unstable financial status with potential for recovery ($1.23<Z'<2.9$). Notably, in the most recent year of observation, enterprise A transitioned into the secure zone ($Z'>2.9$), signifying improved financial stability. In contrast, the assessed values for company B's operational indicators reveal a consistent high-risk profile in both the initial and final years ($Z'<1.23$), with intermittent periods of risk in between. Enterprise C exhibits discernible fluctuations in the Z' indicator throughout the observed timeframe, initially securing a position in the safe zone, followed by two years in the gray zone, and ultimately returning to financial stability. The analysis of company D's indicator highlights an initial placement in the gray zone, subsequently progressing into the distressed zone. During the observed period, enterprise E consistently maintains Z' values between 1.23 and 2.9, placing it within the gray zone.

The analysis of the possibility of bankruptcy, as well as the financial stability and profitability of the observed agricultural enterprises, is shown through the Kralicek Quick test (table 3).

Table 3. Results of Kralicek Quick test for observed agricultural companies

Company	Year	Indicators				Points				Score		
		X_1	X_2	X_3	X_4	P_1	P_2	P_3	P_4	S_1	S_2	T
A	2018	0.49	7.15	0.05	0.09	1	3	4	2	2	3	2.5
	2019	0.50	7.81	0.03	0.09	1	3	4	2	2	3	2.5
	2020	0.54	3.29	0.11	0.18	1	2	3	1	1.5	2	1.75
	2021	0.63	2.57	0.09	0.16	1	1	3	1	1	2	1.5
	2022	0.70	2.11	0.10	0.14	1	1	3	1	1	2	1.5
B	2018	0.03	58.97	0.02	0.02	4	5	4	4	4.5	4	4.25
	2019	0.11	12.53	0.08	0.07	3	4	3	3	3.5	3	3.25
	2020	0.20	8.10	0.11	0.12	3	3	3	1	3	2	2.5
B	2021	0.29	5.78	0.14	0.20	2	3	2	1	2.5	1.5	2
	2022	0.23	18.36	0.06	0.09	2	4	4	2	3	3	3
C	2018	0.60	4.49	0.08	0.05	1	2	4	4	1.5	4	2.75
	2019	0.41	21.36	0.04	0.05	1	4	4	4	2.5	4	3.25
	2020	0.50	9.35	0.06	0.07	1	3	4	3	2	3.5	2.75
	2021	0.69	2.40	0.13	0.09	1	1	2	2	1	2	1.5
	2022	0.67	3.87	0.09	0.07	1	2	3	3	1.5	3	2.25

Company	Year	Indicators				Points				Score		
D	2018	0.70	12.92	0.01	0.08	1	4	4	2	2.5	3	2.75
	2019	0.66	13.95	0.00	0.06	1	4	4	3	2.5	3.5	3
	2020	0.61	6.41	0.02	0.17	1	3	4	1	2	2.5	2.25
	2021	0.52	9.56	0.01	0.16	1	3	4	1	2	2.5	2.25
	2022	0.48	10.03	0.01	0.18	1	3	4	1	2	2.5	2.25
E	2018	0.21	12.37	0.08	0.05	2	4	3	3	3	3	3
	2019	0.20	22.38	0.04	0.03	3	4	4	4	3.5	4	3.75
	2020	0.20	18.01	0.05	0.04	3	4	4	4	3.5	4	3.75
	2021	0.25	7.91	0.11	0.07	2	3	3	3	2.5	3	2.75
	2022	0.27	7.92	0.11	0.05	2	3	3	3	2.5	3	2.75
Average	2018	0.41	19.18	0.05	0.06	1.8	3.6	3.8	3	2.7	3.4	3.05
	2019	0.37	15.61	0.04	0.06	1.8	3.8	3.8	3.2	2.8	3.5	3.15
	2020	0.41	9.03	0.07	0.11	1.8	3	3.6	2	2.4	2.8	2.6
	2021	0.48	5.65	0.10	0.13	1.4	2.2	2.8	1.6	1.8	2.2	2
	2022	0.47	8.46	0.07	0.11	1.4	2.6	3.4	2	2	2.7	2.35

Source: Authors' calculations based on data from financial reports, Business Register Agency

Throughout the observed period, company A had no challenges in asset financing (X_1>10%) and demonstrated efficiency in the timely repayment of liabilities (X_2<12). The average of the previously presented indicators is used to assess financial stability (S_1), which can be rated here as very good (S_1<2) and excellent (S_1<1). Notably, the profitability indicator (X_3) indicates an improvement in profitability, progressing from an initial 5% to a commendable 10% in the final year (reference value 8%). The proportion of cash flow to operating income (X_4) surpassed the established benchmark (5%), signifying lucrative operations. The combined indicator (S_2), calculated as the mean of X_3 and X_4, validates the positive outcomes regarding profitability (S_2<3). The overall solvency rating (T), derived from the average values of S_1 and S_2, attests to the good (T<3) and very good (T<2) performance of the observed company. Conversely, enterprise B underwent a notable improvement in solvency, transitioning from a pronounced risk of insolvency at the beginning of the analysis period. The initial indicators for financial stability (X_1<10% and X_2>30%) and profitability (X_3<8% and X_4<5%) suggested a heightened risk of bankruptcy. In the following years, the solvency ratings improved, so the company was rated as good (T<3) in the last year of analysis. The financial stability (S_1) of company C exhibited a positive trajectory, garnering assessments of good, very good and excellent throughout the observed period. In contrast, profitability (S_2) faced challenges in the initial three years, substantiated by values of indicators X_3 (<8%) and X_4 (<5%). Consequently, the solvency appraisal for the entity in 2019 was bad (T<4) with subsequent years receiving positive evaluations of good (T<3) and very good (T<2). Enterprise D consistently maintained a good solvency rating (T<3) over the analyzed period. However, the profitability indicator X_3 displayed notably low values (0%-2%) compared to the reference (8%), significantly influencing the overall solvency rating. At the beginning of the observed period, company E had values of indicators of financial stability and profitability close to the reference ones, and the

overall solvency was rated as good (T<3). In the next two years, there was an increase in the repayment period (22.38 years and 18.01 years) and a decrease in the profitability indicators X_3 and X_4 below the reference values (8% and 5%). The analyzed changes caused the overall solvency rating drop to bad in this subperiod. In the following years, all indicators improved except for X_4, which had a marginal value (5%) in the last year of the analyzed period and the overall solvency was assessed as good.

The mean values of pertinent indicators concerning agricultural enterprises reveal a substantial presence of internal funding sources (X_1>10%). In the years 2018 and 2019, these companies encountered challenges in the duration of debt repayment (X_2>12), yet their solvency remained unimpaired. The overall assessment of financial stability, on average, leans towards a favorable categorization as good (S_1<3) and very good (S_1<2). In 2018 and 2019, the observed companies did not reach the reference value (8%) in terms of the share of profit before taxation in the total value of assets (X_3), but the value was positive and the companies were solvent. Subsequent years witnessed an improvement in profitability as measured by X_3 and the indicator X_4 consistently surpassed the reference value (5%) throughout the analyzed period. The mean rating of profitability for agricultural enterprises (S_2) points to poor solvency in 2018 and 2019 precisely because of the previously explained indicator X_3, while in the following years solvency was rated as good.

The analysis of the possibility of bankruptcy in agricultural enterprises assessed by the Springate model is presented below (table 4).

Table 4. Values of S indicators for observed agricultural companies

Company	Values of S indicator				
	2018	2019	2020	2021	2022
A	0.686	0.541	1.197	1.266	1.495
B	1.983	2.938	2.345	2.201	1.172
C	1.562	0.902	1.129	2.188	1.497
D	0.240	0.252	0.253	0.080	0.059
E	1.795	1.167	1.390	1.961	2.019

Source: Authors' calculations based on data from financial reports, Business Register Agency

According to the established indicators in Table 4, in the first two years of the analysis, the viability of company A faced jeopardy, marked by classification as precarious with a heightened susceptibility to bankruptcy (S<0.862). In the other years of observation, this enterprise was in the safe zone (S>0.862). The values of the analyzed indicator related to business entities B, C and E, indicate healthy businesses without the risk of bankruptcy. During the observed period, company D had the S indicator values below the reference (0.862) and as such was classified in the distressed zone.

The subsequent section of this discourse entails a comprehensive evaluation of the potential for bankruptcy within companies operating in the food industry throughout the analyzed period, elucidated in Table 5.

Table 5. Values of Z' indicators for observed food processing companies

Company	Values of Z' indicator				
	2018	2019	2020	2021	2022
F	2.323	3.082	2.246	2.205	2.349
G	2.575	2.575	2.493	2.559	2.796
H	2.838	1.060	1.506	1.946	2.638
I	5.933	8.983	6.852	9.574	25.606
J	5.021	5.934	7.233	6.432	7.296

Source: Authors' calculations based on data from financial reports, Business Register Agency

Throughout the observed timeframe, Company F predominantly exhibited Z' indicator values ranging between 1.23 and 2.9, categorizing it within the gray zone. This classification signifies the entity as financially unstable with prospects of recuperation. Noteworthy is the discernment that only in 2019 did enterprise F attain classification within the secure zone The values of the indicator Z' related to company G point to a financially unstable company in the analyzed time interval. In adherence to the stipulated indicators delineated in Table 5, the operational dynamics of enterprise H predominantly inhabit the gray zone, indicative of an unstable financial standing ($1.23<Z'<2.9$). However, in 2019, the company faced an elevated risk, as indicated by $Z'<1.23$. In contrast, business entities I and J enjoyed classification within the secure business zone throughout the analyzed period ($Z'>2.9$).

The evaluation of the potential for bankruptcy, financial stability, and profitability within the observed companies operating within the food sector has been explicated through the utilization of the Kralicek quick test, as elucidated in Table 6.

Table 6. Results of Quick test for observed food processing companies

Company	Year	Indicators				Points				Score		
		X_1	X_2	X_3	X_4	P_1	P_2	P_3	P_4	S_1	S_2	T
F	2018	0.70	0.56	0.13	0.30	1	1	2	1	1	1.5	1.25
	2019	0.79	0.74	0.18	0.34	1	1	1	1	1	1	1
	2020	0.69	1.48	0.15	0.34	1	1	2	1	1	1.5	1.25
	2021	0.68	1.65	0.15	0.33	1	1	2	1	1	1.5	1.25
	2022	0.67	1.69	0.17	0.29	1	1	1	1	1	1	1
G	2018	0.38	4.82	0.12	0.08	1	2	2	3	1.5	2.5	2
	2019	0.40	6.79	0.09	0.05	1	3	3	3	2	3	2.5
G	2020	0.46	8.64	0.05	0.04	1	3	4	4	2	4	3
	2021	0.47	7.21	0.06	0.05	1	3	4	4	2	4	3
	2022	0.44	8.53	0.06	0.03	1	3	4	4	2	4	3
H	2018	0.68	1.53	0.19	0.18	1	1	1	1	1	1	1
	2019	0.45	15.31	0.03	0.06	1	4	4	3	2.5	3.5	3
	2020	0.46	7.63	0.06	0.09	1	3	4	2	2	3	2.5
	2021	0.47	4.84	0.11	0.11	1	2	3	1	1.5	2	1.75
	2022	0.59	2.87	0.15	0.11	1	1	1	1	1	1	1

Company	Year	Indicators				Points				Score		
I	2018	0.92	0.84	0.04	0.16	1	1	4	1	1	2.5	1.75
	2019	0.95	0.85	0.01	0.08	1	1	4	2	1	3	2
	2020	0.94	0.90	0.03	0.20	1	1	4	1	1	2.5	1.75
	2021	0.95	-0.32	0.07	0.35	1	1	4	1	1	2.5	1.75
	2022	0.98	-0.29	0.12	0.57	1	1	2	1	1	1.5	1.25
J	2018	0.19	5.73	0.13	0.03	3	3	2	4	3	3	3
	2019	0.23	5.35	0.11	0.03	2	3	3	4	2.5	3.5	3
	2020	0.31	3.80	0.15	0.03	1	2	1	4	1.5	2.5	2
	2021	0.26	6.13	0.08	0.02	2	3	4	4	2.5	4	3.25
	2022	0.36	3.50	0.14	0.03	1	2	2	4	1.5	3	2.25
Average	2018	0.57	2.70	0.12	0.15	1.4	1.6	2.2	2	1.5	2.1	1.8
	2019	0.56	5.81	0.08	0.11	1.2	2.4	3	2.6	1.8	2.8	2.3
	2020	0.57	4.49	0.09	0.14	1	2	3	2.4	1.5	2.7	2.1
	2021	0.56	3.90	0.09	0.17	1.2	2	3.4	2.2	1.6	2.8	2.2
	2022	0.61	3.26	0.13	0.21	1	1.6	2	2.2	1.3	2.1	1.7

Source: Authors' calculations based on data from financial reports, Business Register Agency

Throughout the observed period, company F consistently achieved excellent financial stability (S_1) and very good to excellent ratings in terms of profitability (S_2). The solvency of this enterprise remained unthreatened, evident in the sustained excellent assessment in the last year, preceded by a very good solvency rating at the beginning of the period. Company G, while maintaining a very good financial stability rating ($S_1<2$) over the analyzed period, encountered challenges in profitability indicators X_3 and X_4 falling below the reference values (8% and 5%) in 2020, 2021 and 2022. This trend influenced the overall solvency rating (T), resulting in a very good rating in 2018 and good ratings in subsequent years. Enterprise H exhibited dynamic solvency trends, ranging from excellent in the initial and final years to very good in 2019 and 2020. While facing a slightly extended debt repayment period in 2019, the overall solvency remained robust. In 2021, improved financial stability and profitability indicators led to a very good overall solvency rating. Company I maintained excellent financial stability (S_1) throughout the observed period. Although the profitability indicator X_3 often fell below the reference value (8%), resulting in a predominantly good profitability rating (S_2), the overall solvency rating indicator (T) consistently pointed to a very good solvency rating. In the analyzed period, the financial stability of business entity J was assessed as good and very good. The profitability indicator X_4 had values below the benchmark (5%), which affected the overall profitability rating (S_2). The overall solvency rating indicator (T) indicates a good solvency rating in most years except for 2021, when the overall solvency rating was poor.

Aggregate indicators for observed food industry companies revealed no challenges in asset financing ($X_1>10\%$) and timely obligation repayment ($X_2<12\%$). The average financial stability was very good ($S_1<2$). In the observed period, the companies reached the reference values of profitability indicators ($X_3>8\%$ and $X_4>5\%$). The average

profitability (S_2) was assessed as good. Overall solvency ratings (T) pointed to very good solvency in 2018 and 2021 with good solvency achieved in other observed years.

The computed values of the Springate model (S) for food companies are presented in Table 7.

Table 7. Values of S indicators for observed food processing companies

Company	Values of S indicator				
	2018	2019	2020	2021	2022
F	1.280	1.658	1.699	1.484	1.574
G	1.880	1.521	1.182	1.212	1.373
H	1.868	0.369	0.880	1.385	1.673
I	0.745	0.375	0.648	1.476	5.542
J	3.822	3.574	4.105	3.294	3.867

Source: Authors' calculations based on data from financial reports, Business Register Agency

The values of the analyzed indicator related to business entities F, G and J indicate healthy businesses without the risk of bankruptcy (S>0.862). Conversely, in 2019, company H faced a precarious operational scenario, marked by classification as unstable with a heightened susceptibility to bankruptcy (S<0.862). In subsequent years under observation, the enterprise effectively navigated into the safe zone (S>0.862). Indicator S related to company I, signifies an initial period of operational vulnerability during the first two years of analysis. However, in the subsequent this business entity consistently operates within the secure zone.

Considering the previously presented findings and solvency assessments of medium-sized enterprises involved in agricultural and food production within the AP Vojvodina region, the following conclusions can be drawn:

Using the Altman Z' score, similar results were obtained as using the Springate model. In relation to previous researches, certain differences can be observed. In their work, Vukadinović et al. (2018) found that Altman's Z' score gave the same results as Kralicek's quick test, which was partially obtained in this research. Kovács et al. (2020) in their paper, determined identical scores using the Altman Z' score and the Springate model, which was also confirmed in this research. In the other mentioned studies, in which the modified Z' score was used (Rajin et al. (2016); Bencová et al. (2021) and Milić et al. (2021)), more rigorous evaluations of the possibility of bankruptcy were obtained with this method compared to other applied models. Given that, the other mentioned models were not used in this paper, it is not objective to make a comparison.

The analysis of the possibility of bankruptcy using the Kralicek Quick test in this paper gave identical results to the aforementioned studies (Rajin et al. (2016); Vukadinović et al. (2018); Tekić et al. (2020) and Milić et al. (2021)). This model gave different assessments of the solvency and financial position of the observed economic entities. The results of the research related to the Springate model coincide with the conclusions of previous research (Kovács et al. (2020); Stoyancheva et al. (2023) and Angelova

et al. (2023)). This model gave identical estimates of the likelihood of bankruptcy as Altman's Z scores. A comprehensive comparative analysis of the potential for bankruptcy and financial position of the studied agricultural and food companies is delineated based on the mean values of the Kralicek Quick test indicators:

Enterprises in both sectors exhibited substantial internal financing capacity (X_1>10%). Although the agricultural companies encountered challenges in meeting the debt repayment period (X_2>12) in 2018 and 2019, their overall solvency remained unimpaired. Conversely, entities in the food sector consistently met their obligations within the stipulated timeframe (X_2<12). The average financial stability throughout the observed period favored companies in the food sector. In 2018 and 2019, agricultural entities failed to attain the reference values (8%) for the profitability indicator (X_3), a distinction not shared by their counterparts in the food sector. Both agricultural and food sector businesses, however, achieved profitability indicator X_4 values exceeding 5%. Notably, the average profitability over the analytical timeframe was superior among companies in the food sector. The composite solvency rating (T) underscores that entities in the food industry enjoy a more favorable solvency rating, implying a diminished risk of bankruptcy.

Conclusions

Amid a volatile economy precipitated by a myriad of global crises, a preemptive analysis of the potential for bankruptcy in enterprises becomes imperative. Drawing insights from previous findings and solvency evaluations of medium-sized companies operating in agricultural and food production within the AP Vojvodina, it is evident that the modified Altman's Z' score and the Springate model yielded predominantly identical solvency ratings. Conversely, the utilization of the Kralicek Quick test resulted in significantly divergent results compared to the aforementioned models. In the observed period, the possibility of bankruptcy was higher for agricultural companies compared to economic entities from the food industry. The merits of this type of research are: the simple application of already formulated models, the availability of a comprehensive database pertinent to the observed models (SBRA) and the lucid presentation of findings. Nonetheless, questions arise concerning the appropriateness of the methodologies used for gauging the likelihood of bankruptcy. The implemented models were not specifically created for the economy of the Republic of Serbia and the analyzed sectors. Therefore, the authors advocate for the development of a dedicated bankruptcy prediction model tailored to the specific economy of the Republic of Serbia. Emphasizing the importance of incorporating considerations for both company size and industry (specifically for agriculture and the food industry), the authors propose the necessity of a nuanced approach in future predictive models. Furthermore, the authors recommend expanding the scope of research by utilizing larger sample sizes and incorporating diverse models for assessing the likelihood of bankruptcy. This includes applying models specifically created for nearby countries.

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Conflict of interests

The authors declare no conflict of interest.

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