sciendo
Contemporary Agriculture
Serbian Journal of Agricultural Sciences
Faculty of Agriculture, University of Novi Sad, Serbia
www.contagri.info

Original scientific paper

UDC: 336.77:338.43
DOI: 10.2478/contagri-2022-0008

CREDIT RATING OF AGRICULTURAL AND FOOD COMPANIES IN VOJVODINA

DRAGAN MILIĆ, DRAGANA TEKIĆ[*]*, TIHOMIR NOVAKOVIĆ, VLADISLAV ZEKIĆ, MILANA POPOV, ZLATA MIHAJLOV*
Faculty of Agriculture, University of Novi Sad, Trg Dositeja Obradovića 8, 21 000 Novi Sad, Serbia
[*]*Corresponding author*: dragana.tekic@polj.uns.ac.rs

SUMMARY

The purpose of this paper is to examine different methods of creditworthiness assessment and bankruptcy prediction in the case of agricultural and food companies in Vojvodina, Serbia. The analysis performed was based on the 2015–2019 financial reports of micro-sized, small-sized and medium-sized agricultural and food companies considered. A total of two models were applied in this study: the Altman's Z'-score model and the Kralicek's Quick test. The Altman's Z'-score model results obtained indicate that the micro-sized agricultural companies were at greater risk of bankruptcy, whereas the small- and medium-sized companies were found stable. However, the Kralicek's Quick test results obtained show that all the agricultural companies considered had good financial stability and solid businesses. The Altman's Z'-score model results obtained for the food companies considered indicate that the micro- and small-sized food companies were endangered, whereas the medium-sized food companies were not at risk of bankruptcy. Moreover, the Kralicek's Quick test results obtained show that all the food companies considered operated successfully with no risk of bankruptcy.

Key words: *Altman Z-score, Kralicek's Quick test, credit rating, bankruptcy*

INTRODUCTION

As one of the basic features of a company, creditworthiness is a synthesized assessment of financial stability, liquidity, solvency, adequacy, capital structure, profitability, position, risk of achieving financial results, and management of the company (Rodić et al., 2011). Creditworthiness assessment is performed on the basis of financial ratios. A financial ratio analysis is a simple method for assessing the creditworthiness of debtors and analyzing the success of a company (Šepa, 2020). Creditworthiness assessment models are also used to assess the company's risk of bankruptcy. A large number of models for credit rating (or bankruptcy risk) have been developed in the world: the Altman's Z-score model, the Kralicek's DF indicator, the Kralicek's Quick Test, the Taffler's model, and others (Alihodžić, 2013). Over the past few years, numerous national and international authors have dealt with the creditworthiness assessment and bankruptcy prediction of agricultural and food companies.

The assessment of creditworthiness and the prediction of bankruptcy of agricultural companies in the Republic of Serbia were performed by Rajin et al. (2016). In their research, the authors applied a total of three models: the Altman's Z-score model, the Kralicek's DF model, and the Kralicek's Quick test. Upon analyzing five agricultural enterprises in the period 2010-2013, the authors concluded that the Kralicek DF model was the most suitable for the creditworthiness assessment and bankruptcy prediction of agricultural enterprises in the Republic of Serbia. Kiaupaite-Grushniene (2016) applied the Altmans Z-score model to assess the creditworthiness of three agricultural companies from Lithuania in the period 2010-2015. They found the Z-score model a useful tool for assessing the creditworthiness and bankruptcy risk of the companies considered. Stojanović & Drinić (2017) assessed the creditworthiness of 270 agricultural companies from the Republic of Srpska in the period 2011-2015 by applying

different versions of the Altman's Z-score model. The results obtained indicate the impossibility of applying the Altman's models to the market observed.
In 2018, Apan et al. applied two credit rating and bankruptcy prediction models (namely the Altman's Z-score model and the VIKOR model) to a sample of 18 food companies from Turkey. The results obtained show that the VIKOR model was more suitable for assessing the creditworthiness of the companies considered.
Vukadinović et al. (2018) analyzed the creditworthiness of three agricultural companies that had undergone privatization. The analysis was conducted in the period 2014-2016, and the Altman's Z-score model and the Kralicek's Quick test were used to assess creditworthiness and predict bankruptcy risk.
Tekić et al. (2020) assessed the creditworthiness of five food companies (in the milling industry of Vojvodina) in the period 2015-2019, using the Altman's Z'-score model and the Kralicek's Quick test. The results obtained show that both models can be used to predict the bankruptcy of milling companies in Vojvodina.
Vavrek et al. (2021) analyzed the possibilities of applying three bankruptcy prediction models (namely the Altamn Z-score model, the Toffler model, and the Credit Rating Index) on 469 agricultural enterprises in Slovakia. The results of this study indicate that the Altman Z-score model and the Credit Rating Index can be used for the creditworthiness assessment and bankruptcy prediction of agricultural enterprises in Slovakia, whereas the results of the Toffler model were inconclusive.
The purpose of this paper is to assess the creditworthiness and bankruptcy risk of micro-, small- and medium-sized agricultural and food companies from Vojvodina in the period 2015-2019, using the Altman's Z'-score model and Kralicek's Quick test. The business performance of all the companies considered was also analyses and compared.

MATERIAL AND METHODS

One of the oldest models for creditworthiness assessment and bankruptcy prediction of a company was constructed by Edward I. Altman in 1968. This model is known as the Altman's Z-score model. The model was formed on the basis of a sample of 66 US companies and 22 financial indicators. It was ultimately reduced to five most important indicators for predicting the risk of company's bankruptcy in a period of 1-5 years (Popov et al., 2020). The following function was obtained by applying a discriminant analysis (Altman, 1968):

$$Z = 1.2 \times X_1 + 1.4 \times X_2 + 3.3 \times X_3 + 0.6 \times X_4 + 1.0 \times X_5$$

The indicators in the discriminatory function are calculated as follows:
Z - Z-score,
X_1 - working capital/ total assets,
X_2 - retained earnings/ total assets,
X_3 - EBIT/ total assets,
X_4 - market value of equity/ book value of total liabilities,
X_5 - sales/ total assets.

According to the Z indicator values, companies are classified into three groups, i.e. business zones: the stable white business zone, i.e. successful (Z above 2.67), the gray zone, i.e. at partial risk of bankruptcy (Z between 1.81 and 2.67), and the distress zone, i.e. at significant risk of bankruptcy (Z below 1.81).
The original model was only applicable to companies whose shares were traded on the stock exchange, so in 1983 Altman modified the original model and constructed the Z '-score model. The difference between the original and the adjusted model is in the indicator , where the market value of capital is replaced by the book value of capital. The Z '-score function has the following form (Altman, 1983):

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

According to the results of this model, companies are also classified into three business zones: the white zone, i.e. successful (Z above 2.9), the gray zone, i.e. at risk of bankruptcy (Z between 1.23 and 2.9), and the distress zone, i.e. at significant risk of bankruptcy (Z below 1.23).
The Kralicek's Quick test, which was formed based on the results obtained from companies in Germany, Switzerland and Austria in the 1990s (Šverko-Grdić et al., 2017), was also applied in this paper. The Kralicek Quick test involves the calculation of four ratio indicators that are awarded a certain number of points, from 1 to 5, which indicate the quality of financial operations of the company. The average of the first two ratios is an indicator of financial stability,

whereas the average of the other two ratios is an indicator of profitability. The average of these two indicators represents the final assessment of the financial position, i.e. the assessment of the company's creditworthiness. Companies with a healthy financial position are evaluated with 1 or 2, 3 points indicate a good financial position, 4 points indicate a bad financial position, and 5 points indicate a high risk of bankruptcy (Vukadinović et al., 2018).
The critical values of the Kralicek's Quick test are shown in Table 1. (http://www.kralicek.at/pdf/qr_druck.pdf).

Table 1. Methodology of the Kralicek's Quick test

Indicators	1 Excellent	2 Very good	3 Good	4 Bad	5 Risk of Insolvency
X_1	> 0.3	0.2–0.3	0.10–0.2	0.0–0.1	Negative
X_2	< 3	3–5	5–12	12–30	> 30
S1= $(X_1 + X_2)/2$ Financial stability					
X_3	> 0.1	> 0.08–0.10	0.05–0.08	0.00–0.05	Negative
X_4	> 0.15	0.12–0.15	0.08–0.12	0.00–0.08	Negative
S2= $(X_3 + X_4)/2$ Total performance and profitability					
T= $[(X_1 + X_2)/2 + (X_3 + X_4)/2]/2$ Total rating					

All the indicators of the Altman's Z score model and the Kralicek's Quick test in this study were calculated according to the average values obtained from the 2015-2019 financial statements of the companies considered (the Serbian Business Registers Agency). According to their size and type, the companies were micro-, small- and medium-sized agricultural and food enterprises in the AP Vojvodina. According to the Law on Accounting, micro-enterprises include those enterprises that do not exceed two of the following three criteria: an average employee number of 10, an operating income of EUR 700,000, and an average value of business assets of EUR 350,000. Small enterprises include those enterprises that do not exceed two of the following three criteria: an average employee number of 50, an operating income of EUR 8,800,000, and an average value of business assets of EUR 4,400,000. Medium-sized enterprises include enterprises that do not exceed two of the following three criteria: an average employee number of 250, an operating income of EUR 35,000,000, and an average value of business assets of EUR 17,500,000 (the Official Gazette of RS, No. 62/2013).
At the end of 2019, a total of 700 food companies were active in Vojvodina (532 micro-sized companies, 99 small-sized companies, 51 medium-sized companies, and 18 large-sized companies). The present study analyzes micro-, small- and medium-sized companies, using a 20% simple random sample from each category (namely 106 micro-sized companies, 20 small-sized, and 10 medium-sized companies).

RESULTS AND DISCUSSION

Table 2. shows the Altman's Z'-score indicator values of the agricultural companies considered in the period 2015-2019.

Table 2. The Z'-score values of the companies considered

Companies size	Value of Z' indicator				
	2015	2016	2017	2018	2019
Micro-sized	0.789	1.014	1.659	0.752	0.802
Small-sized	1.588	2.001	2.991	3.273	3.075
Medium-sized	2.979	2.983	2.936	2.898	3.174

According to the Z'-score indicator values obtained, the micro-sized agricultural companies were in the distress zone during the entire period considered (with the exception of 2017). This can be accounted for by low profitability of these companies, which achieved positive business results only in 2017. The small-sized companies achieved significantly better results throughout the period under consideration, moving from the gray zone (in which they were in 2015 and 2016) to the white zone, i.e. the zone of successful business, in 2017 (in which they remain until the end of the period considered). The medium-sized companies were in the white zone, i.e. successful business zone, during the entire period under consideration, indicating that the medium-sized agricultural companies had a stable financial position and were not at risk of bankruptcy.

Table 3. shows the Kralick's Quick Test results obtained for the agricultural companies considered in the period 2015-2019.

Table 3. The Kralick's Quick test results obtained for the agricultural companies considered

Companies size	Year	Indicator				Points				Score		
		X1	X2	X3	X4	P1	P2	P3	P4	S1	S2	T
Micro-sized	2015	0.368	265	0.054	0.236	1	5	3	1	3	2	2.5
	2016	0.385	213	0.065	0.584	1	5	3	1	3	2	2.5
	2017	0.381	180	0.055	0.542	1	5	3	1	3	2	2.5
	2018	0.407	180	0.055	0.159	1	5	3	1	3	2	2.5
	2019	0.424	214	0.057	2.382	1	5	3	1	3	2	2.5
Small-sized	2015	0.456	76	0.032	0.057	1	5	4	4	3	4	3.5
	2016	0.447	74	0.033	0.056	1	5	3	4	3	3.5	3.25
	2017	0.503	43	0.035	0.120	1	5	4	2	3	3	3
	2018	0.505	49	0.041	0.106	1	5	4	3	3	3.5	3.25
	2019	0.519	41	0.028	0.083	1	5	3	3	3	3	3
Medium-sized	2015	0.515	9	0.048	0.116	1	3	4	3	2	3.5	2.75
	2016	0.522	11	0.053	0.136	1	3	3	2	2	2.5	2.75
	2017	0.518	16	0.034	0.100	1	4	4	3	2.5	3.5	3
	2018	0.517	14	0.028	0.084	1	4	4	3	2.5	3.5	3
	2019	0.503	14	0.026	0.080	1	4	4	3	2.5	3.5	3

The Kralicek's Quick test results obtained indicate that micro-, small- and medium-sized companies had a good credit rating (T = 3) during the entire period under consideration and were not at risk of bankruptcy. Although the micro-sized agricultural companies had no problem with solvency (X_1 > 10%), the prolonged debt repayment period (X_2 > 30) caused lower values of the financial stability indicator (S1). The profitability indicator X_3 values were less than a recommended value of 8%, whereas the share of cash flow in the operating income (X_4) was favorable. The average value of these two indicators forms the basis for profitability assessment, thus the S2 results obtained suggest that micro-sized enterprises had no problem with profitability. The small-sized companies also had no problem with solvency, but their debt repayment period (X_2) was extended. The small-sized companies were found to have low profitability (X_3 < 8%) and a lower share of cash flow in the operating income (X_4 < 15%) than the micro-sized enterprises. Their financial stability was at a good level throughout the period under consideration (S1 = 3), whereas the S2 indicator values suggest that the small-sized agricultural enterprises had problems with profitability. The medium-sized companies had good solvency (X_1 > 10%) and a much shorter debt repayment period (X_2 < 30) than the previous two categories. The medium-sized companies also had problems with profitability (X_3 < 8%) and a low share of cash flow in the operating income (X_4 < 15%). Table 4. shows the Z'-score indicator values obtained for the food companies considered.

Table 4. The Z'-score indicator values obtained for the food companies considered

Companies size	Values of Z' indicator				
	2015	2016	2017	2018	2019
Micro-sized	2.658	1.731	2.532	2.339	2.142
Small-sized	2.873	2.771	2.431	2.437	2.291
Medium-sized	3.941	3.335	2.923	3.061	3.116

The Z'-score indicator values obtained for the micro- and small-sized food companies show that these companies were in the gray zone of business during the entire period under consideration, i.e. at a certain risk of bankruptcy, but still having the potential to improve their business and move to the safe white zone. The medium-sized food companies were in the safe white zone throughout the period under consideration and were not at risk of bankruptcy. Table 5. shows the Kralicek's Quick test indicators calculated for the food companies considered.

Table 5. The Kralick's Quick test indicators obtained for the food companies considered

Companies size	Year	Indicators				Points				Score		
		X1	X2	X3	X4	P1	P2	P3	P4	S1	S2	T
Micro-sized	2015	0.308	93	0.043	0.427	1	5	4	1	3	2.5	2.75
	2016	0.283	185	0.037	0.154	2	5	4	1	3.5	2.5	3
	2017	0.278	30	0.141	0.377	2	5	1	1	3.5	1	2.25
	2018	0.298	44	0.037	2.105	1	5	4	1	3	2.5	2.75
	2019	0.309	34	0.026	0.136	1	5	4	2	3	3	3

Small-sized	2015	0.593	16	0.064	0.066	1	4	3	4	2.5	3.5	3
	2016	0.595	11	0.069	0.081	1	3	3	3	2	3	2.5
	2017	0.562	17	0.049	0.069	1	4	4	4	2.5	4	3.25
	2018	0.578	13	0.048	0.069	1	4	4	4	2.5	4	3.25
	2019	0.539	13	0.061	0.103	1	4	3	3	2.5	3	2.75
Medium-sized	2015	0.502	8	0.088	0.074	1	3	3	4	2	3.5	2.75
	2016	0.453	8	0.078	0.054	1	3	4	4	2	4	3
	2017	0.417	11	0.066	0.051	1	3	4	4	2	4	3
	2018	0.411	11	0.067	0.047	1	3	4	4	2	4	3
	2019	0.424	11	0.071	0.054	1	3	4	4	2	4	3

The micro-, small- and medium-sized food companies had good credit ratings (T = 3) throughout the entire period under consideration and were not at risk of bankruptcy. The micro-sized food companies had good solvency (X_1 > 10%), but they had problems with the debt repayment period, which was much longer than a recommended period of 12 years. The micro-sized companies also had low productivity (X_3 < 8%) and a high share of cash flow in the operating revenues, which was above a recommended value of 15% during the entire period under consideration (with the exception of 2019). The small-sized companies also had good solvency (X_1 > 10%) with a shorter debt repayment period, which resulted in a greater financial stability (2 <S1> 2.5). The small-sized companies exhibited low profitability (X_3 < 8%) and a low level of cash flow share in the operating income (X_4 < 15%). The medium-sized companies had good solvency (X_1 > 10%) and a short debt repayment period (less than a recommended period of 12 years), which increased the values of their financial stability indicator (S1 = 2). The small- and medium-sized companies had problems with low profitability and a low share of cash flow in the operating income.

CONCLUSION

This paper assesses the creditworthiness and bankruptcy risk of micro-, small- and medium-sized agricultural and food companies in Vojvodina in the period 2015–2019. The Altman's Z'-score model and the Kralicek's Quick test were applied for assessing credit rating, i.e. bankruptcy risk. The Altman's Z'-score model results obtained indicate that the micro-sized agricultural companies had poor creditworthiness and were at risk of bankruptcy, whereas small- and medium-sized agricultural companies achieved better results and were in the successful (white) business zone. However, the Kralicek's Quick Test results obtained show that all the agricultural companies considered (namely micro-, small- and medium-sized agricultural companies) had good credit ratings, i.e. they operated successfully and were not at risk of bankruptcy, but had problems with debt repayment time and low profitability. According to the Altman's Z'-score model results obtained, the micro- and small-sized food companies considered operated in the gray zone (slightly better than the agricultural companies), which means that they were at risk of bankruptcy but had the potential to improve and move to the white business zone. The medium-sized food companies had good creditworthiness throughout the period under consideration and operated in the white zone. The Kralicek's Quick test results obtained indicate that all the food companies considered had good credit ratings and were not at risk of bankruptcy. Compared to the agricultural companies, the food companies had a shorter debt repayment period and higher profitability, which contributed to a better credit rating and a higher risk of bankruptcy. Although the food industry is an accompanying industry of agricultural production, its exposure to the risk of bankruptcy is higher due to complex processing procedures employed therein.

The Altman's Z-score model and Kralicek's Quick test results obtained in the present study were found inconsistent, suggesting that the models should be further examined alongside other models of similar purpose stated in the review section of the paper.

***Acknowledgements*:** This paper is a result of the research within the project 142-451-3204/2020-01 financed by the Provincial Secretariat for Science and Technological Development APV.

Conflict of interest: The authors declare that they have no conflict of interest.

REFERENCES

Alihodžić A. (2013): Testing the Kralicek DF indicator application on the Belgrade Stock Exchange. *Banking*, 3:70-95.

Altman I.E. (1968): Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, 23(4): 589-609.

Altman E.I. (1983): *Corporate Financial Distress*, New York, Wiley InterScience.

Apan M., Özte, A., İslamoğlu M.(2018): Comparative Empirical Analysis of Financial Failures of Enterprises with Altman Z-Score and VIKOR Methods: BIST Food Sector Application. *Australasian Accounting, Business and Finance Journal*, 12(1): 77-101.

Kiaupaite-Grushniene V. (2016): Altman Z-score model for bankruptcy forecasting of the listed Lithuanian agricultural companies. 5th International Conference on Accounting, Auditing, and Taxation (ICAAT 2016).

Official Gazette of RS, No. 62/2013 - Zakona o računovodstvu. "Sl. glasnik RS", br. 62/2013.

Popov M., Mihajlov Z., Tica N., Milić D., Zekić V. (2020): Ocena rizika bankrotstva uvoznika i izvoznika poljoprivredne mehanizacije. *Traktori i pogonske mašine*, 24(3-4): 83-86.

Rajin D., Milenković D., Radojević T. (2016): Bankruptcy prediction models in the Serbian agricultural sector. *Ekonomika poljoprivrede*, 63(1): 89-105.

Rodić J., Lakićević M., Vukelić G., Andrić M. (2011): *Analiza finansijskIh izveštaja*. Subotica: Proleter a.d Bečej.

Stojanović T. & Drinić Lj. (2017): Applicability of Z-score Models on the Agricultural Companies in the Republic of Srpska (Bosnia and Herzegovina). *Agro-knowledge Journal*, 18(4): 227-236.

Tekić D., Mutavdžić B., Novković N., Novaković T., Vukelić N. (2020): Analysis of the financial position of mill companies in Vojvodina. *Journal on Processing and Energy in Agriculture*, 24(3-4): 119-122.

Vavrek R., Kravčáková Vozárová, I., Kotulič R. (2021): Evaluating the Financial Helth of Agricultural Enterprises in the conditions of the Slovak Republik using Bankruptcy Models. *Agriculture*, 11: 1-19.

Vukadinović P., Vujović S., Vojnović B. (2018): Analysis of the financial position of enterprises in privatization in the agricultural sector in Serbia. *Economics of Agriculture*, 65(3): 955-970.

Šepa A. (2020): Procena rizika bankrotstva primenom EM-score modela. *Agroekonomika*, 89: 53-71.

Šverko-Grdić Z., Krstinić Nižić M., Mamula M. (2017): Insolvency in the Republic of Croatia, *Economic Research-Ekonomska Istraživanja*, 30(1): 1693-1704.

http://www.kralicek.at/pdf/qr_druck.pdf (accessed 10.12.2020.)

Serbian Business Registers Agency: Available at: https://www.apr.gov.rs/ (accessed 09.10.2020.)

Submitted: 01.04.2021.
Accepted: 15.06.2021.