

## FINANCIAL DIAGNOSTICS OF BANKRUPTCY RISK IN AGRICULTURE: THE CASE OF BULGARIAN ENTERPRISES

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### *Abstract*

*The present study makes financial diagnostics of enterprises from the agricultural sector in Bulgaria in order to carry out a thorough analysis of the trends related to the development of economic processes and the possibility of early detection of financial difficulties. The studied enterprises from the agrarian sector are classified according to levels of financial sustainability, which reveal their ability to generate a positive financial result, to pay debts in a timely manner, to be financially independent, etc. To predict the risk of bankruptcy, well-established models in the world practice are used, including the Altman Z-score model, the Springate model and the Fulmer model. The comparison of the results of more than two models will give us a reliable picture of the state of financial stability of the enterprises. The presence of a high percentage of coincidence between the model forecasts is a reason to claim that the forecasts approximate the real state of financial stability. The results show that at least 1/3 of the surveyed enterprises in the period 2019-2021 are in a state of financial instability.*

*Key words:* agricultural sector, risk of bankruptcy, Z-score models

### INTRODUCTION

The agricultural sector is one of the most vulnerable sectors of the Bulgarian economy in terms of increasing the risk of insolvency and bankruptcy of the companies operating in it.

The problems associated with the unstable political and economic environment, both nationally and internationally, leading to turbulence in the demand and supply of agricultural production. Here could be added the adverse effects of the accumulation of large volumes of inventories in recent years due to the war situation in Ukraine. Another risk factors are not less significant - the impact of climatic and biological shocks, the fluctuations in the prices of input resources – fuels, fertilizers, etc. All this result in an increase in bankruptcies among companies in recent years. According to the COFACE report on corporate insolvencies for Central and Eastern Europe for 2022, Bulgaria once again occupies one of the top eight positions together with Croatia, Hungary, Latvia, Lithuania, Poland, Romania and Serbia (COFACE, 2023) [3]. The same report states that the number of bankruptcy proceedings in

CEE countries increased by 10,173 in 2022 compared to 2021, which is equal to 39.3%. Among the sectors that reported the highest growth in bankruptcy proceedings is the agricultural sector, especially livestock farmers.

The prediction of company bankruptcy is recognized as a significant factor for the normal course web-based of economic activity and for the functioning of enterprises. In this regard, in 2019 The European Union adopted Directive 2019/1023, entitled Directive on Restructuring and Insolvency (European Parliament, EU Directive 2019/1023) [5]. It aims to unify the terms and conditions in the legislations of EU Member States related to preventative restructuring and bankruptcy proceedings. Behind this goal is the idea of developing mechanisms for early warning of financial difficulties and recovery of enterprises, so that they are given a second chance to survive and maintain their viability. The Directive does not give specific instructions, but rather guidelines and the right of each Member State to determine how to approach, according to the characteristics of its economic subjects and the environment

in which they do their business. Two approaches are allowed:

*a/ active* – in it, the individual entrepreneur or persons designated by him, including shareholders or partners, are encouraged to make a self-assessment of their financial situation. It is considered that when financial difficulties are encountered, these have to be signalled to authorities nominated by the state, which in turn will give publicity to the identified problem and propose measures for the recovery of the company;

*b/ passive*–in it, the assessment of financial well-being is assigned to a consulting agency or certified accountants, who objectively analyzes the accounting documents of the relevant enterprise, and also notify its debtors of possible difficulties.

Initially, in 2021 a project called "Bulgaria - Early Warning Tools" gained popularity (World Bank, 2021) [14]. It was developed with the assistance of the World Bank Group at the request of the Ministry of Justice of Bulgaria. At the end of 2023, the Council of Ministers of the Republic of Bulgaria adopts an Ordinance on early warning tools and access to information about enterprises in case of probable bankruptcy (Council of Ministers, 2023) [2].

The document mentioned envisages the Bulgarian SMEs promotion agency creating an information system that promptly signals the danger of bankruptcy.

The work towards the development of tools for early warning of financial difficulties will be increasingly developed and enriched. It is expected to be effective as from December 2024. However, it is still not clear what methods and analysis methodology will be used. It is assumed that an algorithm will be developed to calculate indicators of the financial condition of enterprises, information about liabilities, receivables, etc.

Whether a uniform approach will be applied to all sectors or whether there will be a distinction is not yet clear.

The high capital intensity of production enterprises in the agrarian sector implies a significant volume of costs for depreciation of fixed assets, as well as a significant volume of related material stocks.

The latter sometimes manifests itself in large values of total liquidity at significantly lower levels of quick liquidity indicators.

Regarding the financial performance of agricultural enterprises, we can point to the traditionally lower values of profitability in the sector, while at the same time we observe a large cash flow from operations given the high depreciation costs.

Some authors draw attention to the need to adapt bankruptcy risk assessment models for the agrarian sector as well as for developing economies.

Karas (2015) [8] and Režňáková and Karas (2015) [11] analysed the meaning of selected financial indicators, called "predictors", of enterprises from different economic sectors and found that the same indicators were not equally applicable in different industries. Financial indicators appear to be significant predictors of bankruptcy, for example, for some of the companies studied, but not for companies in the construction or agribusiness sectors.

The authors present some significant specific financial indicators from the agrarian sector, different from industrial enterprises - such are: net working capital to assets, current liabilities to total assets, long-term liabilities to assets and the interest coverage.

M. Karas, M. Režňáková, P. Pokorný (2017) [7] developed this thesis and proved that in the agrarian sector reinvestment of the profit back into the enterprise is of great importance and that depreciation costs are a significant source of operating cash flow. They concluded that due to agribusiness specificity a special attention should be paid to financial performance indicators including EBITDA, such as interest coverage or assets profitability.

Srebro, B. Et al. (2021) [12] also proved that, together with the Altman model, it is necessary to use adapted models to assess the bankruptcy risk in studying firms from the agrarian sector in developing markets. The authors found that some agricultural companies were wrongly classified in the red zone, but when the model was adapted for companies operating in developing markets, they improved their rank.

In order to investigate bankruptcy in the agrarian sector, the purpose of the present study was to apply several analytical models widely used both in theory and in practice to predict bankruptcy risk and to track the degree of conformity of their predictions.

## MATERIALS AND METHODS

A total of 94 small and medium-sized agrarian enterprises, both from the Livestock and the Plant growing sectors, participated in the research.

Data were used from the annual financial reports of the companies for three consecutive years - 2021, 2020 and 2019. We realize that this is a period that coincides with the Covid crisis and affects the financial results in one way or another.

Initially, the analysis applied a methodology for grading the financial sustainability of enterprises by calculating and comparing key financial indicators from the accounting balance sheets (Todorov, 2014; Kulchev, 2023) [13, 10].

Table 1 presents the levels of financial stability adapted according to (Todorov, 2014; Kulchev, 2023) [13, 10].

Table 1. Levels of financial stability

<b>Measures of financial stability</b>	1. TA-TL>0 2. TA-TL>TL 3. (E+NCL)>NCA 4. (CA-CL)>0 5. (W+STL)>Inv 6. (CA-CL)>Inv
<b>Levels of Financial Sustainability</b>	<b>Criteria</b>
Highest level	Measures 1 to 6 are fulfilled
High level	Measures 1 to 5 are fulfilled
Medium level	Option I - Measures 1 to 4 are fulfilled
	Option II - Measures 1, 3, 4, 5, 6 are fulfilled
Low level	Option I - Measures 1 and 2 are fulfilled
	Option II - Measures 3 and 4 are fulfilled
Financial crisis	Measure 1 is fulfilled.
Bankruptcy	None of the measures are fulfilled

Source: The table has been adapted (Todorov, 2014; Kulchev, 2023) [13, 10].

where:

- TA – Total Assets;
- TL – Total Liabilities;
- E – Equity;
- NCL – Non-current Liabilities;
- NCA – Non-current Assets;
- CA – Current Assets;
- CL – Current Liabilities;
- Inv – Inventories;
- WK – Working Capital;
- STL – Short-term Loans.

Three models for predicting the risk of bankruptcy well-established in the global practice have been used in the analysis (Altman, 2000; Freitfalts, 2018; Delev, A., 2016; Kasarova, V., 2010) [1, 6, 4, 9] :

- *The Altman model:*

$$Z = 0.717 * X1 + 0.847 * X2 + 3.107 * X3 + 0.42 * X4 + 0.998 * X5$$

- *The Springate model:*

$$Z = 1.03 * X1 + 3.07 * X2 + 0.66 * X3 + 0.4 * X4$$

- *The Fulmer model:*

$$H = 5.528 * V1 + 0.212 * V2 + 0.073 * V3 + 1.27 * V4 - 0.12 * V5 + 2.33 * V6 + 0.575 * V7 + 1.083 * V8 + 0.894 * V9 - 6.075$$

Altman defined three variants of bankruptcy risk prediction according to Z values, while Springate and Fulmer – two each (Table 2).

Table 2. Interpretation of the integral coefficient values

$Z_{Altman}$		
$Z < 1.23$	$1.23 < Z < 2.9$	$Z > 2.9$
High probability of bankruptcy	Potentially bankrupted	Financially healthy
$Z_{Springate}$		
$Z < 0.862$	$Z > 0.862$	
Financial distress	No financial distress	
$H_{Fulmer}$		
$H < 0$	$H > 0$	
Financial distress	No financial distress	

Source: The table has been adapted (Todorov, 2014).

Table 3 presents the main parameters and ratios involved in the above models.

Next, in order to investigate the probability for enterprises from the agrarian sector to be at risk of bankruptcy, we look for comparability between the results of the financial ratios determining the levels of financial sustainability (Todorov, L., 2014) [13] and the scored of the Altman, Springate and Fulmer models.

Table 3. Insolvency risk forecasting indicators

X Altman		X Springate		V Fulmer Model	
X <sub>1</sub>	WK/TA	X <sub>1</sub>	WK/TA	V <sub>1</sub>	RE/TA
X <sub>2</sub>	RE/TA	X <sub>2</sub>	EBIT/TA	V <sub>2</sub>	SR/TA
X <sub>3</sub>	EBIT/TA	X <sub>3</sub>	EBT/CL	V <sub>3</sub>	EBIT/E
X <sub>4</sub>	MVE/TL	X <sub>4</sub>	SR/TA	V <sub>4</sub>	CF/TL
X <sub>5</sub>	SR/TA			V <sub>5</sub>	TL/TA
				V <sub>6</sub>	CL/TA
				V <sub>7</sub>	Log (Tang A)
				V <sub>8</sub>	WK/TL
				V <sub>9</sub>	Log (EBIT/i)

Source: own contribution.

where:

- WK – Working Capital;
- TA – Total Assets;
- RE – Retained Earnings;
- EBIT – Earnings Before Interest and Taxes;
- MVE – Market Value Equity;
- TL – Total Liabilities;
- SR – Sales Revenue;
- EBT – Earnings Before Taxes;
- E – Equity;
- CF – Cash Flow;
- CL – Current Liabilities ;
- Tang. A – Tangible Assets
- i – interest expense.

For this purpose: (1) we determine the levels of financial sustainability of the enterprises by applying the criteria specified in Table 1; (2) we apply the Altman, Springate, and Fulmer bankruptcy prediction models, and (3) we track the percentage of compliance of the obtained Altman, Springate, and Fulmer model estimates with the levels of financial sustainability. Thus, for each of the defined

financial sustainability levels in Table 1, first, we will obtain the total number of enterprises falling into them and second - the corresponding number of enterprises assessed by Altman, Springate, and Fulmer models matches. We estimate the percentage of enterprise matches by dividing the number of enterprises estimated by the prediction models falling into one level by the total number of enterprises in the same level.

## RESULTS AND DISCUSSIONS

The distribution of the agrarian enterprises included in the study, classified according to their financial stability according to the indicated degrees of financial sustainability, has been graphically presented on Figure 1, Figure 2 and Figure 3.

The Altman model assessment, presenting three categories of financial sustainability, offers the opportunity for a more in-depth analysis. We observe greater dynamics in the change in the number of financially stable enterprises for 2020/2019 compared to 2021/2020 (Figure 1).

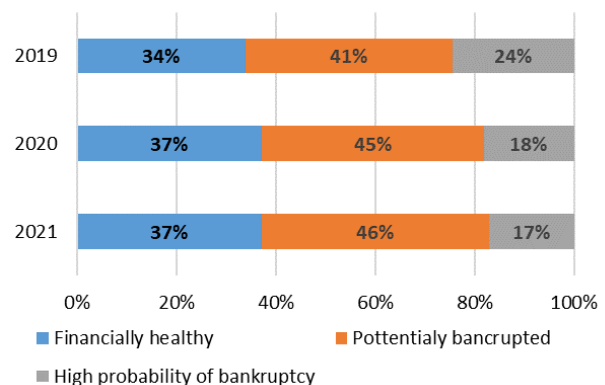


Fig. 1. Distribution of Altman Z score for agricultural enterprises

Source: own contribution.

Only three enterprises managed to improve their financial sustainability in 2020, with the overall relative share of financially healthy enterprises rose to 37% and maintained the same value in 2021. For the period 2019-2021, seven enterprises increased their financial sustainability by improving their assessment from “high risk” to “high risk without risk of bankruptcy”. The amendment

involves a reduction of enterprises with deteriorating financial health by 7 percentage points.

The calculations made according to the Springate model determine an even higher relative share of enterprises in a state of potential bankruptcy (Figure 2). We observed the highest share in 2019, with financially unhealthy enterprises being 59% of all surveyed.

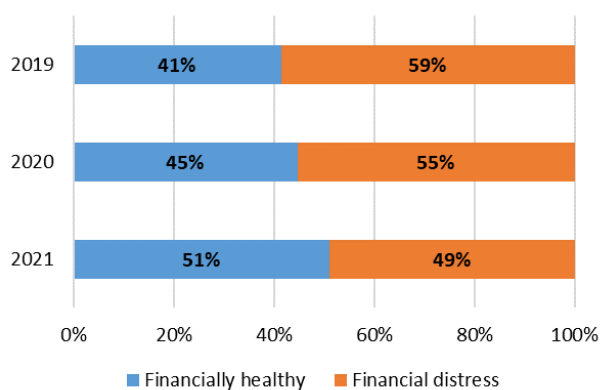


Fig. 2. Distribution of Springate Z score for agricultural enterprises  
 Source: own contribution.

As at 2021, the data showed a significant improvement in the financial health of the enterprises, with 51% of enterprises being financially stable. Although for the three-year period we could see a significant increase in the number of financially sound enterprises by 10 percentage points, it should be noted that the share of enterprises with a high bankruptcy risk stays significant.

Fulmer's model calculations single out 2019 as the year with the highest relative share of 39% of businesses in poor financial health and at risk of bankruptcy (Figure 3). This share decreases to 34% in 2021, and financially stable enterprises increased their share to 65%. During the period, we observed a steady increase of the enterprises with good financial stability.

The forecasts for the financial status of enterprises according to the three prognostic models (Altman, Springate and Fulmer) revealed that the estimates are mutually asserted in a significant percentage of the cases.

We observe a positive trend of the share of agrarian enterprises with good financial stability. All coefficient estimations show an increase on an annual basis, including in 2020.

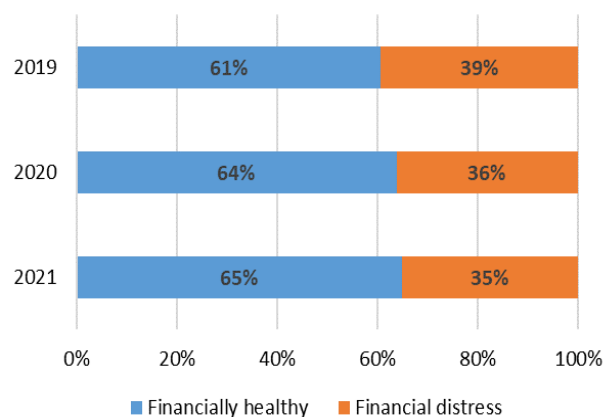


Fig. 3. Distribution of Fulmer H-factor for agricultural enterprises  
 Source: own contribution.

The results of comparing the levels of financial stability and the estimates of the Altman, Springate and Fulmer models are presented in Table 4, Table 5 and Table 6.

For a better presentation of the data, we have combined the number of enterprises appearing in Option I and Option II of Medium level; as well as the ones in Option I and Option II of Low level of stability.

In each table, we proxy the total number of enterprises falling into a given sustainability level to be 100%.

The percentages following the financial distress statuses of the Altman, Springate, and Fulmer models indicate the share of companies whose financial stability matches the corresponding stability level.

When comparing the percentage of enterprises with same financial stability according to both methods - financial sustainability levels and Altman's financial stability statuses, we observed high matches in the upper two categories.

Most precisely, we see that the data show 77% coincidence in 2019 and 2021. (Table 4). The smaller percentage rate of 69% in 2020 could be due mainly to the pandemic situation and the need for enterprises to absorb the shock in the short term.

Table 4. Comparing the financial sustainability levels and Altman model scores

Levels of Financial Sustainability, firms = 100%	Altman's Z	2021	2020	2019
Highest level	Financially healthy	77%	69%	77%
High level	Financially healthy	22%	33%	33%
Medium level Options I and II	Potentially bankrupted	78%	47%	68%
Low level Options I and II	Potentially bankrupted and high probability of bankruptcy	65%	92%	9%
Financial crisis and bankrupt	High probability of bankruptcy	78%	58%	79%

Source: own contribution.

The outstanding number of enterprises (Altman's scores) that do not belong to the highest-level group refers to the second level - "high financial stability": 22%, 33%, and 33%, respectively.

Following the above data, we had the highest percentage of matches in 2020.

Enterprises headed to bankruptcy or with a high probability of becoming bankrupt match 92% of all cases of low financial stability (Option I and Option II).

Considering the Springate model results related to the financial stability categories reveal to us a high matching rate of 85% of the financially stable in 2021 (Table 5).

In the other two models, those values gravitate around 77%.

At the same time, the Springate model predicts very high values of correctly classified enterprises in the Financial Crisis and Bankruptcy group - 100% for 2021, 92% for 2020, and 93% for 2019, respectively.

The Fulmer model closely approximates that of Altman in its predictions.

Table 5. Comparing the financial sustainability levels and the Springate H model scores.

Levels of Financial Sustainability, firms = 100%	Springate's Z	2021	2020	2019
Highest level	Financially healthy	85%	69%	80%
High level	Financially healthy	67%	33%	0%
Medium level Options I and II	Financial distress	89%	53%	55%
Low level Options I and II	Financial distress	42%	71%	82%
Financial crisis and bankrupt	Financial distress	100%	92%	93%

Source: own contribution.

The two integral indicators present a complete coincidence at the two polar levels of financial sustainability, i.e. at "highest level" and "financial crisis and bankrupt". The discrepancies in the other degrees are due to the presence of only two interpretations according to Fulmer and Springate - "financial distress" and "financially healthy" (Table 6).

It should be pointed out that the estimates of the applied models testify that the relative share of enterprises with financial instability remains high during the three-year period.

Table 6. Comparing the financial sustainability levels and the Fulmer model scores

Levels of Financial Sustainability, firms = 100%	Fulmer's H	2021	2020	2019
Highest level	Financially healthy	77%	83%	87%
High level	Financially healthy	89%	33%	33%
Medium level Options I and II	Financial distress	56%	24%	32%
Low level Options I and II	Financial distress	31%	50%	45%
Financial crisis and bankrupt	Financial distress	78%	75%	79%

Source: own contribution.

The minimum value of the relative share of enterprises with an estimated high probability

of a financial crisis and impending bankruptcy has been obtained according to the Fulmer model for 2021 at the amount of 35% - therefore, at least 1/3 of enterprises studied in the period 2019-2021 are in a state of financial instability. We can determine the share of 17% of enterprises with a high degree of risk of bankruptcy according to Altman as being not very small.

A comparative analysis of the Fulmer and Springate scores shows the Springate model as being more restrictive. With both methods, financially stable enterprises increase their share compared to 2019 by more than 10%, but the Springate score defines ½ of enterprises as financially healthy, while according to the Fulmer model this relative share reaches 60%. The difference between the defined relative shares of financially stable (respectively unstable) enterprises for the three-year period between the two models is between 15 and 20 percentage points.

In addition, all models demonstrate the same variation, i.e. higher values for 2019 and 2021 compared to 2020, which was the worst year of the Covid crisis. The fluctuations in the lower degrees of financial sustainability and the discrepancies in the percentage shares among the models are due to the differences in the financial indicators that participate in them, as well as the adopted weights. Examined in detail, we find that the first two models from Table 3 involve almost the same financial indicators, but in different positions and with different constants in front of them.

## CONCLUSIONS

In conclusion, the present study made use of widely applied and proven accuracy models for assessing financial sustainability. We reckon that comparing the results of more than two models can present a reliable picture of the financial sustainability of the enterprises.

We also assume that the higher share of consistency of the models' scores is a reason to claim that the forecast of a bankruptcy risk in the agrarian sector approaches its real state. Based on the five levels of financial sustainability, Springate model compared to

Fulmer model, showed less matching scores of financially healthy enterprises. However, Altman's model turned to be the most restrictive one, as for both categories of financial sustainability – "highest level" and "high level" indicates least match.

The results show very high share of enterprises at risk of bankruptcy. Following the overall consistency of models forecasts, at least 33% of the surveyed enterprises in the period 2019-2021 are at risk of financial instability, although we observe an increase in the share of financial healthy enterprises.

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