# POSSIBILITY OF APPLICATION OF CLASSICAL BALANCE SHEET MODELS FOR PREDICTING SOLVENCY - THE CASE OF SMEs IN RURAL AREAS OF THE REPUBLIC OF SERBIA

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## Abstract

*Prediction of company solvency is a current topic in theory and practice. The main focus is on Altman's Z-score model, which provides an acceptable and simple analysis of the overall company profile, while the possibility of applying other balance sheet models has been neglected. In modern conditions, the precautionary principle dictates, that in the bankruptcy prediction, the outcomes of several different balance sheet models should be always taken into account. Therefore, the paper focuses on the analysis of the corporate solvency using the most basic Altman Z-score, as well as on understanding the applicability of Zmijewski and Chesser balance sheet models. The aim of the paper is to integrate, in an efficient and relevant manner, the limited propositionalability of the Altman's Z-score with an integrated solvency analysis for a more reliable prediction of the solvency of small and medium-sized companies (hereinafter: SMEs) in rural areas of Serbia. The research findings affirm the feasibility of the application of balance sheet prediction models for signalling insolvency in our business practice, through implementation of the integrated methodology of classic balance sheet models, thus creating a more reliable and objective support for the prognosis of survival by means of the growth and development of SMEs in the rural areas.*

*Key Words: solvency, balance sheet models, SMEs, rural areas*
*JEL classification: M21, G33, G01*

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## Introduction

The research problematics of maintaining solvency of the company shows that the total number of bankruptcies in the EU companies, between 2010 and 2013, has increased by 28.9%. In Western Europe, the total number of bankruptcies has been increased by 10.2% and in Central and Eastern Europe by 89.3% (Đukić, 2015). Out of the 28 EU countries, six countries have witnessed a decreased number of companies' bankruptcy, while in 22 countries this number increased significantly. In the observed period, the number of companies in bankruptcyin the Republic of Serbia decreased, but the level of creditors' settlement is low, thus indicating high risks of illiquidity and insolvency of our economy. In times when the economic sector is not capable of 'keeping' transaction money in circulation, its great portion is flowing out through allocation and payments to other sectors and spending (Tešić et al., 2012). The trend of a continuous increase in the bankruptcy risk, or the threat for the stakeholders, represents also a significant danger to the development of our economy, our rural areas. The share of agriculture in the GDP of rural areas amounts to 29.81%, which is significantly higher than in other transitional countries, since Serbia has significant resources for the agricultural production (Čavlin & Đorđević, 2014). For all these reasons, it is important to use the potentials and tools of the environment analysis, which is an important factor of business success, with the purpose to timely identify and anticipate such potential future situations in the environment (Ignjatijević et al., 2018). Therefore, the paper contributes to the affirmation of classical balance sheet model models, as a necessary systematic analytical apparatus for a reliable diagnosis and treatment of SMEs business distress (internal and external). In order to achieve the objective of the paper, along with the literature analysis and descriptive approach, in the literature review the selected balance models of bankruptcy prediction have been investigated, the adequacy of their application in real situations has been tested, wherein for the calculations of the indicators the data from the official financial statements of selected SMEs from rural areas in the Republic of Serbia, for the period from 2013 to 2017, has been employed.

## Literature review

The history of development of models for predicting bankruptcy has begun with the univariate model which has been conceptualized by Beaver (1966) on the basis of 30 ratios of 79 failed companies in 38 different industries. Beaver (1966) had found that net income/total liabilities had a higher

prognostic ability (92% forecast accuracy one year before failure). The initial multivariate model for predicting bankruptcy was developed by Altman (1968), who provided a key contribution to the development of this model. Altman (1968) conducted the survey on a sample of 66 companies with two groups: 33 companies that went bankrupt and 33 companies that did not go bankrupt by means of multiple discriminant analysis, i.e. financial and economic ratios based on accounting data. In the subsequent research, Altman (1993, 2000) has significantly modified and developed a multi-discriminatory model called the Z-Score for for Private Firms (Z') and Non-Manufacturers and Emerging Markets (Z'). In the following decades, subsequent research on insolvency and bankruptcy prediction models was conducted while the authors Wu et al. (2010) point out the following work as the most significant: Altman (1968), Zmijevski (1984), Hillegeist, Keating and Cram (2004). The development of prediction models has influenced the expansion of the framework and techniques of their construction, most often by application of multivariate discriminant analysis, logit analysis, probit analysis and neural network (Bellovari et al., 2007). Significant progress in the development of prediction models occurred in the 1990s with the development of more sophisticated techniques for analyzing larger databases, while in recent years the so-called 'soft' computer techniques have been developed. In contrast to traditional methods, these methods better cope with imprecisely defined problems, incomplete information, inaccuracies and uncertainties. In addition to the prediction models, modern prediction models based on incorporating the influence of macroeconomic, business and corporate factors are developed on the basis of increasingly advanced computer techniques (Dyrberg, 2004). The study is primarily based on the analysis of certain prediction models, which were developed by multivariate discriminant analysis, without neglecting the importance of other models. Balance sheet prediction models developed by Altman (1968), Chesser (1974) and Zmijevski (1984) are based on accounting parameters, while the model Hillegeist et al. (2004) are based on market parameters. According to Agarval and Taffler (2006), there is little difference in the predictive accuracy of balance sheet and market based models. The main difference is that balance sheet based models are more adapted to credit risk prediction. The focus of the research is on the classic balance sheet models that measure liquidity, leverage and profitability. The essence of the analytical approach is determined by the knowledge that low liquidity and profitability implies a high degree of leverage, which directly increases the likelihood of bankruptcy. The differences between the balance sheet prediction models are reflected in the selection of variables and statistical

techniques that are used to forecast bankruptcy. The reliability of the model is not determined by the number of variables incorporated, because certain 2-variable models have the same prediction accuracy capacity as the 21-variable models. In the case of a limited number of variables, the propositional power of the model may be incomplete or its representativeness may be inadequate. Multicollinearity may occur in case of too many variables in the model. Recent scientific studies from our country analyze the predictors of bankruptcy, primarily the classical balance sheet models, among which the Altman Z-score has captured the greatest attention. This model was explored by Muminović et al. (2011), Đuričin et al. (2018), Rajin et al. (2016), Stanišić et al. (2013), and the Zmijewski model was investigated by Pavlović et al. (2011), until the Chesser model has been taken into theoretical consideration. The abovementioned authors, from our country, highly emphasize that for the sake of validation of the reliability of prediction bankruptcy models, a substantial number of companies, markets, economic activities and periods should be included in the analysis.

## Overview of selected balance sheet-based models of solvency prediction

Numerous balance sheet models, based on the initial Altman model, have been developed, in both the literature and the business practice, and adapted to the specific markets, areas and economic activities. The research emphasizes the advantages of balance sheet based models in comparison with the classical prediction models and especially with the market models. The following risks were identified (Agarvala & Tafflera, 2006): balance sheet is of historical nature, the principle of conservatism in accounting increases the risk of deviation from the carrying amount of assets, accounting data is subject to the risk of management manipulation, financial statements in the context of 'going-concern' concepts are not appropriate for prediction of bankruptcy.

**Altman Z-score model** is the most significant balance sheet prediction model that was developed by Edward I. Altman, who published his first research in 1968 that was based on the relationship of ratios and bankruptcy probabilities, created a multivariate prediction model called the Z-score (Altman, 1968). The author developed a model based on data analysis for 66 US manufacturing companies from 1946 to 1965, by analysing two equal groups of companies: 33 enterprises that went bankrupt and 33 'healthy' companies. The study has primarily identified 22 indicators,

which were selected and reduced to five ratios by the criterion of the highest discriminatory power, by means of the multivariate discriminant analysis. The discriminatory function of the original model is:

$Z = 1{,}2X_1$ (Working Capital/Total assets) + $1{,}4X_2$ (Retained earnings/Total assets) + $3{,}3X_3$ (Earnings Before Interest and Tax/Total Assets) + $0{,}6X_4$ (Market value of equity/Total liabilities) + $1{,}0X_5$ (Total Sales/Total assets)

The criteria for model evaluation are:

- a Z-score of a company lower than 1.81 indicates a risk of financial distress, i.e. high possibility of initiating bankruptcy proceedings 'distress zone'; a Z-score above 2.99 indicates a financially stable company and represents a 'safe zone'; a Z-score within the interval of 1.81 to 2.99 represents the so-called 'gray zone'.

The research also tested the accuracy of the discriminatory function on the sample of companies and found that the accuracy significantly decreased as the coverage of predictions extended (Altman, 1968). In a series of subsequent studies, which included three periods during the next three decades (until 1999), the model was found to be approximately 80%–90% accurate in predicting bankruptcy one year before the event, and of approximately 15%–20% classifying the firm as bankrupt when it does not go bankrupt (Altman, 2000). Altman (1993) performed two revisions to improve the model. The first revision focused on the adaptation of the prediction model of financial distress to those companies whose shares are not quoted on the stock exchange, i.e. private companies. Pursuant to the premises of the modified model, in the racio indicator (X4) the market value of the equity was replaced by the book value, and the relative importance or the parameters' ratio weights was corrected and therefore the new revised function of the Altman Z-Score for a private company is as follows:

$Z' = 0{,}717X_1 + 0{,}847X_2 + 3{,}107X_3 + 0{,}42X_4 + 0{,}998X_5$

In the revised model interpretation, new extreme critical values were defined:

- private companies whose value of the Altman's indicator is $Z' \leq 1.23$, i.e. below these values are in the bankruptcy zone and unable to take a bank loan, and

- private companies whose value of the Altman's indicator is Z`≥ 2.90 i.e. above these values are in the safety zone and their business is sustainable.

The second revision of the model is the result of efforts to adapt the model to the prediction of financial distress of non-manufacturing companies with the aim of eliminating the distortion of the results of the basic model. Altman modified the model by excluding the racio indicator (X5) from the calculation process because it may differ substantially in various sectors. In constructing the indicator (X4), it uses the carrying amount of equity. Altman's Z-Score for non-manufacturing companies or the so-called '4-variable Z-Score' model is as follows:

$Z'' = 6{,}56X_1 + 3{,}26X_2 + 6{,}72X_3 + 1{,}05X_4$

The second modification of the model led to the change of the critical values of Altman's Z-Score, which are now defined in the range of values from 2.60 to 1.10, as follows:

Z"≥ 2,6 'Safe Zone'; Z"≤ 2,6 - Z " ≥ 1,1 'Gray Zone'; Z"≤ 1.1 'Distress Zone'.

The Emerging Market Score Model (EM Z-Score Model) was adapted to the original Altman Z-Score model which was developed for closed corporations and non-manufacturing companies (Altman, 1993). The original Altman Z-Score implied that companies issue equity which is publicly traded, which made it unsuitable for emerging markets that do not have such a viable market conjuncture or even the capital structure of companies. Based on the conducted research, 'Z-EM Score Model' function was created and modified as follows:

$Z\text{ - EM Score} = 3{,}25 + 6{,}56X_1 + 3{,}26X_2 + 6{,}72X_3 + 1{,}05X_4$

"Z - EM Score" model encompasses private companies in emerging markets, and the critical values of the indicators are defined in the range of 2.60 to 1.10, as follows:

Z EMS ≥ 2,6 "Safe Zone"- the risk of bankruptcy and financial distress is very low; Z EMS ≤ 2,39 ≤ 2,59 "Gray Zone" - a zone of concern, but bankruptcy and extremely unfavorable financial position are unlikely to occur in the next two years; Z EMS ≤ 1,11 ≤ 2,38 "Gray Zone"- a zone of

high risk of bankruptcy and extremely unfavorable financial position; Z EMS ≤ 1,10 "Distress Zone"- the risk of bankruptcy and extremely poor financial position is expected to be 70% within two years or 95% within one year.

Based on the "Z - EM Score" parameter, an equivalent credit rating is also determined. Critics of the Altman models point out that they were not created as a result of theoretical research but as a result of practical research on the market, especially in the US, which in some situations may limit the prognostic power of the model (Altman, 2000).

**Zmijewski model** was formulated to include the indicators that measure the profitability, indebtedness and liquidity of the company. Zmijewski model was developed by the analysis of 800 non-bankrupt companies and 40 companies that have gone bankrupt (Zmijewski, 1984). A 99% probability of predicting bankruptcy accuracy was determined (1984) on a sample of bankrupt companies, from the New York Stock Exchange in the period 1972-1978, from all industries except finance, insurance and real estate. In his research, Zmijevski (1984) has taken up a sample of companies that are bankrupt and the companies in which the bankruptcy was initiated, or the petition for bankruptcy was filed. Based on the conducted research and multivariate probit analysis, he created a function as follows:

$Y = -4{,}3 - 4{,}5X_1 + 5{,}7X_2 + 0{,}004X_3$

The identified racio indicators in the model are as follows:

$X_1$ = Net Income/Total Assets; $X_2$ = TotalLiabilities/Total Assets; $X_3$ = Current Assets/Current Liabilities;

After calculating the value (Y), the probability of bankruptcy is calculated as follows:

Bankruptcy Probability Indicator = $P = 1/(1 + e^{-y})$

The model interpretation is as follows: if the probability obtained is greater than 0.5, then the company is considered to have a high chance of bankruptcy, i.e. insolvency.

Further research outlines some limitations of this model that are due to the classification of a sample that does not differentiate between bankrupt and non-bankrupt companies. Zmijevski (1984) investigated 13 models of prediction of the bankruptcy in the literature and highlighted the problem of reliability regarding the selected sample and prediction. Therefore, it can be summarised that for the sake of reliability the researchers should base their models on a sample that is large enough to be representative and use appropriate statistical techniques of probability estimation to test the reality of the bankruptcy prediction of a company.

**The Chesser model** was essentially developed as a credit assessment tool, to detect non-compliance with the terms of the basic loan agreement or its monitoring (Chesser, 1974). According to the research, the probability of the prognostic power of the Chesser model is around 75%, and it is most often used in forecasting the collection of receivables of manufacturing companies and customer loans. The model as a final outcome indicates the likelihood of whether the company will enter into the problem of inability to service the loan and settlement of credit obligations. Bearing in mind the importance of the liquidity analysis, as the primary factor of mutual trust between the business partners, the Chesser model stands out as an indispensable tool in analysing and predicting the risk of companies'sustainable cash flow. The identified racio indicators in the model are as follows:

$X_1$= Cash and cash equivalents/Total assets; $X_2$= Net sales/Cash and cash equivalents; $X_3$= Profit before tax / total assets;

$X_4$=Total debt/Total assets; $X_5$= Long term assets/Net asset value; $X_6$= (Current assets - Current liabilities)/Net sales;

Based on the conducted research, the following function has been created: $Y=-2.043 + 5.24X_1 + 0.0053X_2 – 6.6507X_3 + 4.409X_4 – 0.0791X_5 – 0.1020X_6$

Indicatorof the probability of default: $P = 1/(1 + e^{-y})$

The interpretation of the results indicates that if the derived probability is greater than 0.5, the company will have a problem in servicing its credit obligations, and if the derived probability is less than or equal to 0.5, the company will have no problem in timely settlement of credit obligations. We highlight the relevant research by Lithuanian authors Kanapickien and

Marcinkevicius (2014) that point out that when the outcomes of the Chesser model cannot be expressed, the reliability of the model is significantly reduced, but when the outcomes are equated to zero, the case study in the Lithuanian shows the construction sector companies that the corrected Chesser model becomes the most accurate bankruptcy prediction model. An integrated conceptual analysis is necessary for the relevant evaluation of the financial performance, as it represents the foundation and key segment for identifying a company's strategy. In this way, the company shall be enabled to capitalize the forces that can increase its competitiveness and reduce weaknesses that can adversely affect the company's business.

## Results - an example of SMEs from rural Serbia

An analysis of insolvency prediction models was conductedin the period from 2013-2017 in four companies. SMEs from the trade sector, or more specifically from the wholesale trade services of beverages, were selected for the analysis and its indicators were taken from the publicly available information or the official financial statements, which were submitted by the selected companies to the Business Registers Agency of the Republic of Serbia and from direct insight into company financial reports.

Table 1: *Companies according to the criteria of insolvency in the 2018*

| **Insolvency status of the company** | **Wholesale trade services of beverages** | **All economic activities** |
|---|---|---|
| Account blockage | 14.80% | 4.10% |
| Bankruptcy | 1.22% | 0.18% |
| Liquidation | 4.79% | 1.04% |
| Temporary suspension | 0.61% | 3.21% |
| Tax debtor | 0.09% | 0.01% |
| Active | 33.16% | 46.65% |
| Deleted | 45.33% | 44.81% |

From Table 1 it can be seen that in the group of companies for wholesale trade services of beverages, 14.80% of the companies have the account blockage and this percent is significantly higher in comparison with the account blockages of the companies from all economic activities (4.10%); the percentage of companies in bankruptcy in the group of companies for wholesale trade services of beverages is 1.22% in comparison with the companies from all economic activities (0.18%) and the percentage of companies in liquidation in the group of companies for wholesale trade

services of beveragesis 4.79% in comparison with the companies from all economic activities (1.04%), which indicates a high level of solvency risk in the group of wholesale trade activity in relation to the total economy, i.e. economic activities.

Table 2: *An overview of companies according to legal form in the 2018*

| **Legal form of company** | **Wholesale trade services of beverages** | **All economic activities** |
|---|---|---|
| A limited liability company | 73.17% | 18.00% |
| Entrepreneur | 23.94% | 75.30% |
| Partnership Company | 1.94% | 0.42% |
| Joint Stock Company | 0.09% | 0.25 % |
| Other | - | - |

From Table 2 it can be seen that in the group of wholesale trade services of beverages, the legal form of companies is dominated by "Limited Liability Companies" (73.17%) which significantly differs from the legal forms in all economic activities as the "Limited Liability Companies" is represented with 18% in all economic activities while the prevalent legal form is "Entrepreneur" with 75.30%. This predominant legal form of compaies in the group of wholesale trade services of beverages can be interpreted as appropriate for the conduct of a specific trade services activity.

Table 3: *An overview of companies according to size in the year 2018*

| **Company size** | **Wholesale trade services of beverages** | **All economic activities** |
|---|---|---|
| Micro | 82.55% | 90.07% |
| Small | 14.09% | 8.42% |
| Medium | 3.36% | 1.11% |
| Large | - | 0.40 % |

From Table 3 it can be seen that in the group of wholesale trade services of beverages, according to the size, the micro companies represent 82.55% of all companies, which is slightly lower than in all other economic activities, where micro-enterprises represent 90.07% of all companies. Therefore, it is indicative that in the observed economic activity, obviously due to its specificity, there are no conditions for the development of large enterprises, opposed to the conjuncture of the overall economy in which large enterprises are represented by 0.40%. The analyzed companies in the group of wholesale trade services of beverages, that have a favorable financial position, as shown in Table 4, have the following characteristics: Limited

Liability Companies, of medium size, over twenty years of business operations, "1B" did not have an account blockage in the last three years, and "1A" had three partial account blockages.

Table 4: *Information on selected companies with favorable financial position*

| Criteria | Company: 1A | Company: 1B |
|---|---|---|
| Legal form | DOO | DOO |
| Company size | Medium | Medium |
| Year of establishment | 1999 | 1993 |
| Number of account blockage | 3 | - |

Table 5: *Information on selected companies with unfavorable financial situation*

| Criteria | Company: 1A | Company: 1B |
|---|---|---|
| Legal form | DOO | DOO |
| Company size | Mikro | Mikro |
| Year of establishment | 2014 | 2006 |
| Number of account blockage | 4 | 4 |
| Bankruptcy year | 2018 | 2018 |

The analyzed companies in the group of wholesale trade services of beverages, that have an unfavorable financial position, as shown in Table 5 have the following characteristics: Limited Liability Companies (DOO), of micro size, over three years and more than 13 years of business operations, both companies have had four account blockages. Out of a total of 1149 companies in the group of wholesale trade services of beverages, in the last year bankruptcy proceedings were initiated in 14 companies. The companies in which the bankruptcy proceedings were initiated in 2018 were selected as a representative example. Adapted and revised Altman Z-score and Altman Z-EMS indicators, as well as Chesser and the Zmijewski models, were used in the analysis. The selected companies with a favorable financial position that have been analyzed according to the revised Altman Z-score and Altman Z-EMS model have been in the "safe zone" in almost every year, except for the company "1A" indicators which in the last two years, according to Altman Z-EMS, were slightly below the recommended highest value. The selected models of indicators confirm the validity of the prediction, because the companies during the analysed period have "safely" and solidly "swum" and maintain stable in the financial flows. At the same time, in addition to the evaluation of the financial position as per the results of the Altman models, we can point out that as per the results of the Chesser

model the companies are able to pay loans, and as per the results of the Zmijewski model they are not in the bankruptcy zone, which confirms the previously determined favorable financial position of the selected companies.

Table 6: *An overview of selected unique weighted indicators with favorable financial position*

| DESCRIPTION | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| **1.Altman z score** | | | | | |
| Company "1A" | 4.20 | 4.21 | 4.77 | 3.99 | 4.70 |
| Company "1B" | 6.81 | 6.33 | 8.56 | 8.16 | 8.88 |
| **2.Altman Z-EMS** | | | | | |
| Company "1A" | 3.76 | 2.92 | 3.36 | 2.48 | 2.52 |
| Company "1B" | 6.81 | 6.33 | 8.56 | 8.16 | 8.88 |
| **3. Cheser model** | | | | | |
| Company "1A" | 2.14 | -0.26 | -0.85 | -0.98 | -1.61 |
| Company "1B" | 0.86 | -1.54 | -2.48 | -1.72 | -2.36 |
| **4. Zmijevski model** | | | | | |
| Company "1A" | -0.02 | -3.13 | -3.59 | -3.42 | -4.02 |
| Company "1B" | -1.27 | -4.39 | -5.04 | -4.16 | -4.89 |

Table 7: *An overview of selected unique weighted indicators with unfavorable financial position*

| DESCRIPTION | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| **1.Altman z score** | | | | |
| Company "2A" | 1.02 | 0.47 | 1.67 | 0.34 |
| Company "2B" | - | 3.28 | 0.74 | 0.43 |
| **2.Altman Z-EMS** | | | | |
| Company "2A" | 2.25 | -4.08 | -11.73 | -68.82 |
| Company "2B" | - | 3.53 | 0.87 | -0.20 |
| **2. Zmijevski model** | | | | |
| Company "2A" | -4.38 | 4.30 | 4.30 | 4.30 |
| Company "2B" | - | 0.3 | -3.31 | -3.17 |

According to Altman's indicators the selected companies with unfavorable financial position are, in the observed period, in the 'Distress Zone' with high bankruptcy risk. In the year 2015, the company value of Altman's Z-EMS indicator is in the safe zone, but in the next year its value decreased and the company entered the zone with high bankruptcy risk. In this company, the bankruptcy occurred within two years, which confirms the solid prognostic value of these indicators. In addition to assessing financial position, according to the Altman models, we can point out the similarity

of outcomes and reliability of the prediction according to the Zmijewski model, which confirms the appropriateness of application of these models.

After testing and analyzing the presented prediction models, we can conclude that there is no significant difference in the prediction reliability of the presented individual prediction balance sheet models. Taking into account all the results of the previous research, the current testing and analysis of prognostic models, it can be concluded that the selected balance sheet models can relatively accurately and timely predict the financial problems of the company, thus they are recommended as indispensable in a comprehensive analytical apparatus.

## Discussion

The paper analyses the capacity of bankruptcy prediction models Altman (1968), Chesser (1974) and Zmijewski (1984) based on balance sheet data and indicators of profitability, leverage and liquidity. For almost decades, the application of these models has been a focus of the research practice in the developed European countries and the US, while lately the analysis of their applicability arouses interest and research in transitional European countries. This limitation of this study refers to the sample size and the timeframe, and also to the risk of subjectivity and its static character that stems from relying solely on the company accounting data. The selected companies are extracted from a relatively small sample size of our economy and the paper focus is on SMEs from the group of wholesale trade services of beverages in the Republic of Serbia. Analysing the balance sheet models for prediction, we can see that the following relationships are most commonly used to construct a synthetic indicator: working capital/assets, profits/assets, sales/assets and sales/cash. The essential focus of the balance sheet models is on assessing the effectiveness of assets employment and their contribution to sales and returns. All balance sheet models for bankruptcy prediction rely on similar techniques and financial ratios and vary according to different weights as signed to the significance in the changes of the companies' financial position determinants. The differences between these models, that appear primarily in the domain of statistical techniques and determining variables, as well as in the effects of their application in different conjunctions of transition and developed markets, emphasize the necessity of analysing the possibility of their application in the economy of the Republic of Serbia. Our research was based on the application of the Altman Z-score model, that is, classical balance sheet models (except the so-called Chesser model) and it was

predominantly focused on certain economic activities and groups of companies that encompassed a different sample size, companies and timeframe. Rajin et al. (2016) tested the Altman's Z-score and Kralicek's model on companies from the agricultural sector and their findings show that each of the tests gave them a variety of responses and conclusions regarding the business operations of the company. Therefore, the authors recommend that indicators of different tests should be always taken into account when analyzing bankruptcy prediction. Pavlović et al. (2012) performed a testing of the Zmijewski model on the example of companies listed on BELEX from different branches, although the selected sample did not adequately reflect the overall state of our economy. The research of Pavlović et al. (2011) has included 62 successful businesses and 32 non-performing businesses in the non-banking sector. The average accuracy for the total sample in the observed period 2006 to 2010 was 94.2%, which is slightly lower than the value of the original Zmijewski model whose probability of accuracy was 98%. The author's conclusion is that this model can be widely used in our country to identify companies that are facing financial difficulties, especially in the industrial sector. Đuričin et al. (2018) point out that the application of Altman's Z-score model for assessing the likelihood of bankruptcy can provide an opportunity for a simple analysis of the overall company profile that is based on five key indicators of business success. Their research has focused on companies from the real sector of economy in the year 2015. The authors have also pointed out that the results of the model application may be useful for policy makers of the Republic of Serbia, as well as for managers of medium-sized enterprises. Stanišić et al. (2013) investigated three models with standard and specific financial indicators to predict the opening the bankruptcy proceedings in the emerging markets with recessionary characteristics. They have tested several new models, logistic regression method, decision trees method and artificial neural networks method, on the initial sample of 130 companies. On the sample of 102 companies they have compared the prediction accuracy of new models with the prediction accuracy of Altman's Z-score models. Their findings show that of the 3 models mentioned above, in the independent samples test, when compared to the Altman Z-score models, only the neural network model shows better results. The authors conclude that the implementation of the Altman model is acceptable for bankruptcy prediction in the Republic of Serbia, but that it is necessary to develop and test the model on new samples, emerging markets and surrounding markets. The effects of applying the Chesser model in transition countries can be seen in the example of Lithuania, where Mackevičius and Silvanavičiūtė (2006), on the example of 433

companies in the construction sector, whose bankruptcy proceedings lasted from the year 2009 till 2013, tested the classic models for bankruptcy prediction including the Chesser model. Mackevičius and Silvanavičiūtė (2006) point out that the basic Chesser model is not very suitable to be applied to all companies, because its outcomes often differ from the Altman model and the real financial situation of the company, but it has a similar prediction rate (78% a year preceding bankruptcy) for the companies whose shares are not listed on the stock market and for service companies, just like Altman models. Even though the revised Chesser model cannot be applied to 1% of companies, if utilized and constructed in this way, the revised Chesser model can become one of the most reliable models for bankruptcy prediction of Lithuanian companies, and can be recommended as one of the indispensable models for bankruptcy prediction. After the conducted analysis and research we can conclude:

- that the bankruptcy analysis should always takes into account the outcomes of different models;
- that the Altman's Z-score model gives us a possibility to analyse, in an acceptable and rather simple way, the overall company profile based on five key indicators of business success;
- that in our country the Zmijewski model can be used to identify companies that are facing financial difficulties, especially in the industrial sector;
- the so-called revised Chesser model is one of the most reliable models of bankruptcy prediction and can be recommended as one of the indispensable tools of analysis;
- it is necessary to develop and test models on new samples, emerging markets and markets in our region;
- the application of only one model for bankruptcy prediction is not completely reliable, but it is deemed appropriate to use and combine multiple models, whose results and risks need to be continuously presented and compared in compliance with changes in the financial position of the company; and
- the research findings indicate that the combination of Altman, Zmijewski and Chesser models constitutes a relevant and reliable framework for timely and adequate diagnosis of the financial position of companies in our country.

To conclude, we can point out that it is not possible to create only one universal reliable model of corporate bankruptcy prediction. It would be appropriate to create specific bankruptcy prediction models and its

combinations for certain industries and markets. Our suggestion is to take the high risk of bankruptcy of each individual model as a warning signal and to once again carry out an external and internal analysis of the company's position, and in particular the analysis of the financial performance. On the basis of the bankruptcy prediction, investment and financial decisions are made, resources are assessed and employed and company's perspectives are evaluated. All this points to the need to develop the capacity of the company to collect and consolidate information about its business activities and to analyse them objectively and timely. The contribution of this research is reflected in the improvement of the sustainable financial management and the understanding of the reliability of balance sheet synthetic indicators, as a tool for proactive management. The research findings primarily point out that the Altman's Z-core model is suitable for a simple and rapid assessment of a company's financial position, but good analytical practice requires a relevant and reliable assessment and its implementation in a multi-model integrated analytical framework. All selected models justify that unfavorable financial position of our companies can be used as a predictor in order to predict the risks of survival, growth and development of the company. The research findings represent an input for further scientific research and they can be also used in business practice. Future research should be expanded to take into an analysis other statistical techniques and prognostic models. Further research that would include longer time periods, a large sample of companies, of all sizes and across all industries, would greatly contribute to theory and practice and would create the opportunity to create a modified model for bankruptcy prediction that is suitable for our market.

## Conclusion

All companies have risks that they face on a daily basis of all kinds from the currency risk to risk of sale, acquisition, loss of assets, etc., which determine their business operations. Integrated management requires aligning these risks with the dimensions of business and strategic management. Insolvency risk is one of the most significant risks that a company can be face, as it can lead to its bankruptcy. The situation of illiquidity and insolvency of SMEs has direct negative consequences for the company, and indirect negative consequences for social actors, especially in rural areas. Creating an optimal, comprehensive concept for predicting bankruptcy on the basis of several models, has an aim to identify future events, in a quick, easy, relevant and timely manner, in order to maintain and improve the business flows of the companies in the rural

areas. Taking into account also the limitations, a relatively reliable and integrated implementation of the selected balance sheet models can be suggested for the proactive identification of the SMEs in solvency risks and sustainable development of the rural areas.

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