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CREDIBILITY OF FOREIGN DISCRIMINATORY MODELS IN RELATION TO THE ASSESSMENT OF THE FINANCIAL CONDITION OF POLISH ENTERPRISES. CASE STUDY OF E. ALTMAN'S METHOD

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Abstract

The article is an attempt to assess whether foreign discriminatory models can be used in conditions of the Polish economy. To date, there is no one voice on this issue. There are views that this approach is wrong. It results from different factors affecting a given economy, or another character of the economy itself. Another issue is also differences in financial reporting of individual countries, which is translated into financial data. In turn, a different view is presented by the trend that foreign models can be used in the conditions of the Polish economy, while the differences that appear do not significantly affect the quality and reliability of the received diagnosis. Accordingly, the article attempts to verify both above positions. For the purposes of the study, the article presents the results of research on a sample of 25 bankrupt companies from the years 2012 to 2017, which declared liquidation bankruptcy, and their 25 healthy counterparts. The diagnosis of their financial situation was made using E. Altman's model of 1983. The results of the study confirm the validity of the thesis that a more correct solution is to adopt the second thesis, namely foreign models can be used in the conditions of the Polish economy, but only after suitable modifications and consideration of the Polish economic conditions. In contrast, the use of foreign models without such a procedure should not take place. Such an approach may have an impact on receiving an incorrect diagnosis which does not correspond to the real situation in the surveyed entity.

JEL classification: M40, G17, G32, G33
Keywords: E. Altman's Method, methods of the early warning, bankruptcy of enterprises, financial standing of companies, financial analysis

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Introduction

The publication in 1968 of the discriminatory model for the assessment of bankruptcy prediction by E. Altman should be considered the beginning of the period of interest in the issues of models assessing the financial condition of companies (Altman, 1968). On the basis of this model, a number of modifications of the method appeared. Also, the idea itself turned out to be an impulse to take increased attempts to create discriminatory models that can contribute to a fair diagnosis of the financial condition of the company. The popularity of the model entails many traps. One of them is undoubtedly the question of whether and how one can apply the model estimated on a sample of companies in the United States to a Polish company? Well, there is an ongoing duet of opinions on this issue. The practice shows that the popularity of Altman's model is remarkably high among expert accountants, auditors and other persons involved in the assessment of financial statements. It is worth noting that Altman's model is immensely popular in other countries, where one can also find a lot of interesting studies and scientific publications (e.g.: Mandell, 1992; Synek, 2000; Mazilescu, 2010; Camska, 2012, Kočišová 2012). In connection with the above, an attempt was made further to assess which attitude is more appropriate.

Literature review

Many literature items addressing the issue of financial analysis cite E. Altman's model and its modifications made by the author himself. However, in most of them, there are also positions that applying this model in practice is the right approach. On the other hand, one can find positions that say that such an approach is just unacceptable. The first and second thesis have almost the same number of supporters and opponents.

Nowak believes that foreign models cannot be transferred to the Polish conditions without prior modification of them. Without doing so, one can get very confusing diagnoses (Nowak, 2005). Mączyńska and Zawadzki formulated a view that the use of models arising in the context of foreign economic conditions is possible, but only after their "adaptation" to the Polish conditions (Mączyńska & Zawadzki, 2006). That view is also shared by Zarzecki (Zarzecki, 2000), and Rogowski, who also considers possibility to use foreign models, but after their suitable modification (Rogowski, 1999). These ideas are also shared by Hamrol (Hamrol, 2004), M. Zaleska (Zaleska, 2012), Kuciński (Kuciński, 2011), and Kitowski (Kitowski, 2011). In turn, a different position is represented by e.g. Krawiec, who with the help of an original version of Altman's model assessed the financial situation of airlines (Krawiec, 2011). Beszterda diagnosed the condition of companies listed on New Connect using Altman's model (Beszterda, 2011). Gostomczyk used Altman's model to study a commercial and production company (Gostomczyk, 2012). In contrast, Wasilewski and Domańska assessed the financial condition of a fat industry company Zakłady Tłuszczowe Kruszwica S.A. using E. Altman's model (Wasilewski, 2012). However, Tomczak studied the financial situation of the municipal transport companies (Tomczak, 2010). Hamryszczak, using Altman's model, predicted the financial condition of hospitals (Hamryszczak, 2012). Also Pochopień and Balin state in their publication that Altman's model is a universal tool and in the conditions of the Polish economy, the results do not differ significantly from those that could be received in Altman's homeland (Pochopień & Balin, 2012). On the other hand, Sołoma with Plesiewicz used Altman's model to assess the financial situation of meat industry companies (Sołoma & Plesiewicz, 2011). Mosionek-Schweda evaluated five companies listed on the NewConnect using four Altman models. On the basis of the analysis of the financial situation, the author formulates the view that these models, despite some limitations, showed high prognostic effectiveness (Mosionek-Schweda, 2014). On the other hand, the results of the research conducted by Iwanowicz lead to different conclusions. Based on 439 financial statements published by 139 companies (including 79 that declared bankruptcy), the author verified Altman models. The results obtained reject the view that the Altman model is being transferred to the conditions of the Polish economy and the sectoral versatility of the models (Iwanowicz, 2018).

Interesting conclusions are also drawn from the research conducted by Micherda, who in his work published the results of examining the financial statements by expert auditors. It turned out that almost 40% of them (exactly 38.41% of respondents), in the process of examination and evaluation of financial statements, use E. Altman's method in the part concerning the assessment of the financial situation (Micherda, 2012).

These studies, as well as the practice of people dealing with issues of auditing financial statements and

examining the financial condition of companies every day, justify the validity of the addressed problem. Although a similar type of research has already been carried out - there is still no one consistent position regarding the use of foreign models for the conditions of the Polish economy. In connection with the above, an attempt was made to address the prevailing views.

Methodology and the research results

In order to verify E. Altman's model of 1983 some data were collected in 25 bankrupt companies and their 25 healthy counterparts. The data of the companies that declared bankruptcy were from the years 2012-2017. An application for declaration of liquidation bankruptcy was filed with the district court against these companies. The companies came from the industry, services, and construction sector, operated in 9 provinces: the Podkarpackie Province, the Świętokrzyskie Province, the Małopolskie Province, the Lubelskie Province, the Dolnośląskie Province, the Śląskie Province, the Opolskie Province, the Mazowieckie Province, and the Podlaskie Province. On the other hand, 25 companies with good financial condition were selected as entities similar in terms of their activity, asset structure or size to the bankrupt companies. A period of five years was analysed, and the last period analysed was the year of declaring bankruptcy. The companies included in the "healthy" group were analysed in the same period.

E. Altman's model of 1983 was verified. The original model, which was published in 1968, was not used in the survey due to the use by the fourth index in the construction of the data for enterprises whose shares are listed on the stock exchange. Due to the research sample, the calculation of this ratio, and thus the model, would be largely impossible and would result in a low level of credibility in the obtained results. It was therefore decided to reach for the method from 1983, which does not use the information from the outside. The obtained results for comparability were confronted with diagnoses of two logit models, four discriminatory models, and one scoring method. Such tools for verification were selected due to the popularity of discriminatory methods, which are still the most popular among the statistical methods. In terms of popularity, the second place is held by logit methods, hence their presence in the study. In contrast, the scoring model served as a kind of alternative in reaching for early warning models (Aziz & Dar, 2006).

E. Altman's method - the model of 1983 uses the following function: $Z_{EA83} = 0.717W_1 + 0.847W_2 + 3.107W_3 + 0.42W_4 + 0.998W_5$. The function value less than or equal to 1.2 is bankruptcy, above or equal to 2.9 is a good financial condition (Altman, 1983).

The logit methods chosen for the study are the following:

1) Wędzki's model of 2005, with the function $Z_{DW} = -4.0 - 6.0W_1 + 9.387W_2 - 2.088W_3 + 1.317W_4 + 0.04W_5 - 4.217W_6$. The function value less than or equal to 0.5 means a good financial condition; while above it - predicts bankruptcy (Wędzki, 2005);

2) Korol's model of 2010, with the function $Z_{TK} = 2.0 - 10.19W_1 - 4.58W_2 - 0.57W_3$. The function value less than or equal to 0.5 means a good financial condition; while above it - predicts bankruptcy. It is worth noting that it is a conventional determination of the limit value, because the author himself did not specify such a level. The adoption of value 0.5 was due to the fact that the testing sample contained approximately a bankrupt ratio (Korol, 2010).

The discriminatory models used in the research are the following:

1) Appenzeller and Szarzec's model with a discriminatory function form: $Z_{DA} = 0.819W_1 + 2.567W_2 - 0.005W_3 + 0.0006W_4 - 0.0095W_5 - 0.556$. The function value above zero means a good financial condition; while below it - predicts bankruptcy (Appenzeller & Szarzec, 2004);

2) the Poznań model (Hamrol) with a discriminatory function form: $Z_{MH} = 3.562W_1 + 1.588W_2 + 4.288W_3 + 6.719W_4 - 2.368$ The function value above zero means a good financial condition, while below it - predicts bankruptcy (Hamrol, 2004);

3) the "G" INE PAN model by Mączyńska and Zawadzki with a discriminatory function form: $Z_{EM2} = 9.498W_1 + 3.566W_2 + 2.903W_3 + 0.452W_4 - 1.498$. The function value above zero means a good financial condition; while below it - predicts bankruptcy (Mączyńska & Zawadzki, 2006);

4) Maślanka's model with discriminatory function form: $Z_{TM} = -0.41052 + 1.59208W_1 + 4.35604W_2 + 5.92212W_3$. The function value above zero means a good financial condition; while below it - predicts bankruptcy (Maślanka, 2008).

The scoring model used to verify the results of E. Altman's methods is a modified scoring method for assessing banking risks according to Hołda. A variant of this method allows determining the place of the studied company in the industry using financial ratios (Hołda, 2002). Therefore, a bit different than discriminatory or logit models it presents the results of the carried-out studies that mostly do not consider the specifics of the industry. Depending on the number of points a company can get one of four places:

- a very low place when it obtains 12-20 points;
- a standard place when it obtains 21-30 points;
- a good place when it obtains 31-40 points;
- a very good place when it obtains 41-48 points.

Individual indicators after the calculation refer to the value of indicators for the industry (Hołda, 2002).

The article presents the results of the survey for the last period (the year of declaring bankruptcy for companies included in the group of bankrupts) - Table 1. Due to the multiplicity of the received information, it was decided to present only the final results of each tool. For the clarity of results, the bankrupt companies are symbolized by B1, B2, B3 etc. In contrast, healthy companies are symbolized Z1, Z2, Z3 etc. Values in bold indicate a correct diagnosis.

In the last period of research, the point model according to Hołda's modifications was characterized by the best prognostic reliability. The model allocated accurately 84% of the surveyed entities. Another model with the highest predictive reliability was the Poznań model - 80%, and the „G" INE PAN model by Mączyńska. Assessing the number of correct diagnoses obtained using E. Altman's method, it should be noted that 21 cases were assessed correctly. In percentage terms, this means the accuracy of 42%. At the same time, it was the worst score among all the models used.

The detailed results are presented in Table 2 - which presents the models according to the effectiveness of the received results - in percentage terms, and also shows the number of correct diagnoses and errors.

For both groups, that is the entities with good financial condition and the bankrupt companies, their financial condition could be diagnosed correctly or incorrectly. In the event of an incorrect diagnosis, the error could be of the first degree - it consists in an erroneous assignment of an entity with a good financial condition to the group of bankrupts, or of the second degree - that is, the assignment of a bankrupt to a group of "healthy" companies. These are classification errors (*ex-ante*). There are also prediction errors (*ex-post*). In this case, it is the

Table 1: The results of the research for the last period analysed

Model / Entity	E. Altman's	D. Wędzki's	T. Korol's	D. Appenzeller and K. Szarzec's	Poznań	„G" INE PAN	T. Maślanka's	A. Hołda's Point Model
Diagnosis:	Z <= 1.2 bankruptcy	Z> 0.5 bankruptcy	Z> 0.5 bankruptcy	Z<0 bankruptcy	Z <0 bankruptcy	Z<0 bankruptcy	Z<0 bankruptcy	12-20 points very low place of the entity
B 1	**-1.78**	**1.50**	**1.89**	**-0.89**	**-1.56**	1.22	0.56	**Very low 17 points**
B 2	2.31	**1.67**	2.2	**-1.29**	**-2.57**	**-1.29**	**0.77**	**Very low 17 points**
B 3	2.02	**1.38**	-2.09	**-3.17**	**-1.44**	**-3.21**	**-1.39**	**Very low 19 points**
B 4	1.89	**2.1**	-0.48	**-0.28**	**-0.74**	**-0.91**	**-2.19**	Standard 21 points
B 5	3.20	**2.2**	-3.29	**-1.29**	**-1.76**	1.56	**-3.12**	Standard 25 points
B 6	1.99	-0.92	**3.58**	**-0.67**	**-4.47**	**-3.29**	**-1.48**	Standard 23 points
B 7	2.01	-1.11	**6.49**	1.29	**-0.59**	**-0.98**	0.49	**Very low 18 points**
B 8	**-2.09**	**2.13**	**8.27**	**-0.56**	**-0.74**	**-1.28**	**-0.11**	**Very low 13 points**

B 9	**0.85**	**1.29**	-0.94	**-0.93**	**-3.32**	**-1.19**	**-2.18**	**Very low 15 points**
B 10	1.79	**2.37**	**7.19**	1.39	**-0.97**	0.29	3.28	Standard 28 points
B 11	1.89	**3.11**	**2.18**	1.79	0.94	**-1.04**	1.87	Good 32 points
B 12	**-2.21**	-2.19	**1.29**	4.20	2.04	2.38	1.48	**Very low 12 points**
B 13	1.75	-0.98	**1.38**	**-3.27**	**-0.72**	**-0.56**	3.48	**Very low 17 points**
B 14	4.27	-1.09	**1.57**	**-2.18**	**-1.84**	**-3.78**	2.39	**Very low 16 points**
B 15	3.38	**1.48**	**1.56**	**-2.56**	**-2.87**	1.38	**-2.39**	Standard 29 points
B 16	3.15	**2.34**	**1.79**	**-4.37**	**-5.94**	**-2.67**	**-1.93**	**Very low 17 points**
B 17	2.37	**0.98**	**3.29**	**-1.29**	**-0.27**	1.48	**-1.22**	**Very low 15 points**
B 18	**1.18**	0.36	**3.28**	**-0.38**	**-0.87**	**-0.58**	**-0.94**	**Very low 16 points**
B 19	1.72	-2.19	**0.89**	3.29	5.29	2.68	**-3.13**	Standard 22 points
B 20	2.19	**3.58**	**0.57**	3.20	4.26	**-1.67**	**-1.44**	Standard 21 points
B 21	2.37	**1.85**	-1.29	0.38	**-1.18**	**-0.95**	**-0.87**	**Very low 19 points**
B 22	4.35	**1.29**	-4.59	**-0.84**	**-0.42**	**-1.28**	**-1.29**	**Very low 14 points**
B 23	5.11	-2.38	**1.49**	**-1.29**	**-1.91**	**-0.48**	**-1.33**	**Very low 15 points**
B 24	3.33	-1.37	**1.67**	0.48	1.48	2.18	**-1.49**	**Very low 18 points**
B 25	**-2.90**	-0.98	**0.79**	0.58	3.82	**-0.59**	0.93	**Very low 20 points**
Z 1	0.18	0.78	0.94	**1.77**	**0.27**	**1.11**	**1.11**	**Standard 23 points**
Z 2	0.92	0.93	**0.45**	**1.87**	**4.73**	**1.90**	**1.49**	**Standard 28 points**
Z 3	1.14	1.28	1.38	**1.57**	**2.78**	**2.78**	**1.58**	**Standard 27 points**
Z 4	**2.11**	**-2.38**	0.69	**2.18**	**0.81**	**2.38**	**3.49**	**Good 31 points**
Z 5	**1.71**	**-1.37**	0.59	**2.58**	**1.45**	**1.29**	-0.19	**Good 33 points**
Z 6	**2.31**	**-3.19**	**-2.18**	**2.67**	**4.07**	-0.97	-0.94	**Very good 46 points**
Z 7	**5.93**	**0.38**	**-1.38**	**2.70**	**3.30**	**2.29**	-0.47	**Very good 45 points**
Z 8	-1.29	**0.28**	**-1.48**	**3.28**	**0.53**	**1.14**	**2.87**	**Very good 47 points**
Z 9	**2.39**	0.97	**-1.28**	**3.17**	**1.58**	**1.15**	**3.57**	**Good 33 points**

Z 10	**2.84**	0.71	**-1.57**	**1.28**	**3.87**	**2.39**	**2.39**	**Good 39 points**
Z 11	-3.29	**-1.28**	**-0.38**	**1.57**	-0.67	-1.34	**2.19**	**Very good 43 points**
Z 12	0.85	**-0.98**	0.59	-0.96	-2.64	**1.27**	-1.29	**Very good 42 points**
Z 13	0.18	-1.28	-2.18	-0.56	0.16	2.19	-0.57	Very good 48 points
Z 14	**3.47**	**-0.29**	**-3.29**	**-1.34**	0.54	**0.79**	**0.67**	**Very good 46 points**
Z 15	**5.68**	**-2.93**	0.89	-1.48	-0.87	**0.89**	**1.45**	**Very good 42 points**
Z 16	**3.13**	**0.27**	1.09	**0.58**	**1.48**	**1.49**	**3.19**	**Good 40 points**
Z 17	-2.17	**0.35**	1.39	-1.48	-3.17	-0.81	**0.97**	**Good 38 points**
Z 18	-0.57	**0.47**	2.19	-3.49	**0.37**	-1.90	-0.48	**Good 37 points**
Z 19	**1.36**	0.76	2.67	**0.57**	**2.78**	**2.18**	-1.28	**Good 40 points**
Z 20	**3.29**	**-0.38**	**-0.87**	**0.18**	**1.25**	**2.39**	**2.38**	**Standard 23 points**
Z 21	**2.57**	**-0.57**	0.81	-0.23	**1.14**	**2.19**	**1.29**	**Standard 28 points**
Z 22	-3.28	**-0.96**	2.17	**2.58**	**1.78**	**1.38**	**-0.93**	**Good 33 points**
Z 23	**7.63**	**-2.84**	3.29	**0.67**	**0.57**	**3.12**	**-1.38**	**Good 38 points**
Z 24	**3.29**	**-3.75**	**-0.78**	-0.85	**1.54**	**0.79**	**2.17**	**Good 37 points**
Z 25	**4.57**	**-1.38**	**0.34**	**1.29**	**4.79**	**1.57**	**3.18**	**Very good 43 points**

Source: Own study based on the financial statements of the surveyed companies

Table 2: Classification of early warning methods by the relevance of research results for the last period

Model	Percentage of accurate forecasts	Number of correct assessments	Number of wrong assessments	
			1st degree error	2nd degree error
PMORB by A. Hołda	84%	42	0	8
The Poznań model (M. Hamrol's)	80%	40	4	6
„G" INE PAN model by Mączyńska and M. Zawadzki	76%	38	4	8
D. Wędzki's model	68%	34	6	10
T. Maślanka's model	68%	34	7	9
D. Appenzeller and K. Starzec's model	66%	33	8	9
T. Korol's model	62%	31	13	6
E. Altman's model	42%	21	10	19

Source: Own study on the basis of the research results

improper classification of the studied company in a fixed time horizon (Pociecha, 2007).

Conclusion

The conducted research confirms the position in the literature of people who claim that it is possible to use foreign early warning models only and exclusively after a prior modification to the Polish economic conditions. In the absence of the model adaptation, foreign tools should not be used. On the other hand, the use of foreign models without their prior adaptation will be burdened with a high probability of receiving an erroneous diagnosis. The obtained results also brought information about the reliability of individual early warning models. The study used E. Altman's model, but also the Polish discriminatory models and a scoring method for assessing banking risk. And it is this last method - counted among the scoring models, that showed the highest credibility. In 84%, the received results meant a correct diagnosis of the sample companies. High places among the Polish discriminatory models were taken by the Poznań model with 80% efficiency and the "G" INE PAN model by Mączyńska and Zawadzki, with 76% efficiency. In the next place was the logit model of Wędzki with 68% efficiency.

Referring the percentage of accurate forecasts to the result of E. Altman's model, which amounted to 42%, it can be confirmed that foreign models should not be used without prior modification. At the same time, it is necessary to reject the thesis of people whose position in this matter is the lack of the earlier adaptation of foreign models to the conditions of the Polish economy and the possibility of their free use - according to the original design assumptions. The results of the conducted study are convergent with the results of the authors' research, which state the thesis that there is no possibility of transferring foreign models to the terms of the Polish economy. Based on the research, the author assumes the position on the inability to use foreign models for the conditions of the Polish economy without their previous adaptation.

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