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PREDICTING CORPORATE BANKRUPTCIES IN POLAND AND LITHUANIA – COMPARATIVE ANALYSIS

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Abstract: The research on predicting bankruptcies of enterprises constitutes one of the most important areas of financial management. In developed countries, the first publications on the subject appeared in the early twentieth century. The situation is different in the countries of Eastern Europe, which introduced the market system already at the beginning of the 1990s, which resulted in first corporate bankruptcies. The article compares the experiences in the field of forecasting corporate bankruptcies in two countries of Eastern Europe, i.e. Poland and Lithuania, confronting them with the results of research conducted in developed countries. In the conclusions the similarities and differences between the two countries were shown and the future directions of research on this issue were proposed.

Keywords: corporate bankruptcy prediction, bankruptcy risk, fundamental analysis

JEL classification: G31, G33, C38

Introduction

The bankruptcies of enterprises constitute an indispensable element of a properly functioning market economy. They have a negative impact on many stakeholders, in particular providers of capital, business partners and employees. Hence a particularly high emphasis is placed on creating models predicting the risk of corporate bankruptcy. While studying the literature in the area of corporate finance, one may note that this issue is very timely and more and more scientists engage in research devoted to this subject. The corporate bankruptcy forecasting models are most often used to assess the risk of counterparty or borrower default. They also allow for determining company ratings. Such models can also serve as synthetic measures of the financial condition of companies. In developed countries, models of such type have been created and used for many years, while in the countries of Eastern Europe the interest in them appeared only upon the change of the economic system, that is to say relatively recently.

The purpose of this article is to conduct a comparative analysis of research on forecasting corporate bankruptcy in two countries of Eastern Europe, i.e. Poland and Lithuania, and to confront them with the experiences of developed countries. This publication is an introduction to the implementation of more extensive analyses using information on a larger number of Eastern

European countries. The research method used was analysis of literature. The first part of the article provides an overview of research in the field of forecasting bankruptcy of enterprises in developed countries. The second part was devoted to listing the most important studies carried out in Poland and Lithuania. In the last section the experiences of both countries were compared and recommendations for further research were shown.

Overview of research on the phenomenon of forecasting corporate bankruptcy

The research on predicting corporate bankruptcies was initiated in the United States in the early twentieth century. Originally it consisted in ratio analysis, within the framework of which attempts were made at predicting the risk of corporate bankruptcies based on several measures. The literature available to the author shows that already in 1908 Rosendale (1908, p. 187, as in Beaver in 1968, p. 114) tried to evaluate the risk of insolvency of companies on the basis of information on their current assets. Other authors involved in research in this area were: Ramser and Foster (1931, as in Back et al., 1997), Fitzpatrick (1932, as in Waśniewski and Skoczylas 1993, p. 438), Winakor i Smith (1935), Merwin (1942, as in Back et al., 1997) and Beaver (1966). The latter applied a one-dimensional discriminant analysis. On the basis of a number of financial measures he determined the discriminant strength of each of them separately. For this purpose, the percentage of correct and incorrect predictions in the five years preceding the bankruptcy of enterprises was calculated. The breakthrough came, however, in 1968 — after Altman's publication (1968). He also took into account the simultaneous impact of several indicators on the financial condition of the company by combining them into a single measure (*Z*-score), which was used to assess the threat of bankruptcy. He also used the technique of the multivariate linear discriminant analysis. Altman (2015), alone or in collaboration with other scientists, later developed numerous other models, dedicated to both the American companies and to companies from other countries (Altman and Narayanan, 1997). He found many followers in the United States and abroad, and the multivariate linear discriminant analysis has become the most popular technique used to build corporate bankruptcy forecasting models (Bellovary et al., 2007; Aziz and Dar, 2006).

In the 1970s and early 1980s the linear multivariate discriminant analysis was criticized, which resulted in the emergence of the logit and probit analysis in studies in the field of forecasting corporate bankruptcy (Chesser 1974; Martin, 1977; Ohlson, 1980; Wiginton, 1980, as in Härdle et al., 2004; Zavgren, 1983; Zmijewski, 1984). In the 1970s and 1980s as an alternative to the linear multivariate discriminant analysis method and the logit and probit method studies were published in which the authors used other techniques, such as linear programming, the method of recursive division or cluster analysis. Another significant breakthrough came in the early 1990s. At that time the nonparametric methods began to be used in evaluating the threat of corporate bankruptcy — especially the artificial neural networks (Odom and Sharada, 1990; Raghupathi et al., 1991, as in Jo et al., 1997; Coats and Fant 1991-1992; Tam and Kiang, 1992; Fletcher and Goss, 1993; Rahimian et al., 1993; Wilson and Sharda, 1994; Boritz and Kennedy, 1995; Serrano Cinca, 1997).

Recent years have also seen a group of new methods from the area of forecasting corporate bankruptcy, categorized as the so-called soft computing techniques². Such a direction of progress stems from the use of computer applications that enable the implementation of advanced computational processes. This type of methods, in addition to the above-mentioned artificial neural networks, may include i.a. genetic algorithms, the method of support vectors or fuzzy logic. In contrast to traditional statistical techniques, such as multivariate linear discriminant analysis or logit and probit analysis, these methods cope better with imprecisely defined problems, incomplete data, inaccuracy, imprecision and uncertainty. They process information in cases difficult to illustrate in the form of algorithms and do this in conjunction with the symbolic representation of knowledge (Korol, 2010b, p. 2).

Predicting corporate bankruptcies in Poland and Lithuania – research overview

Lithuania

In the period after the Second World War the Lithuanian bankruptcy law was adopted on 15 October 1992, while the first cases of corporate bankruptcies appeared only in 1993³. As a result, the interest in the problems of forecasting corporate bankruptcy appeared very late in comparison to many developed countries — it should be noted that it was the consequence of the fact that Lithuania became independent only in 1990, when the change of economic system also occurred. The pioneering research in the field of forecasting bankruptcy of Lithuanian enterprises took place only at the end of the twentieth century, which was most likely related to the lack of or limited access to data. A detailed literature analysis of the research on forecasting the bankruptcy of Lithuanian enterprises was conducted by Kanapickiene and Marcinkevičius (2014). Due to the passage of time and access to other literature sources it has already been supplemented with additional publications and presented in Table 1. It shows that Lithuanian scientists used the overseas models to assess the risk of bankruptcy of Lithuanian enterprises, in particular those estimated by Altman, Taffler & Tishaw, Springate, Zavgren and Chesser, relatively frequently. The analysis of literature on the basis of which the table was drawn up leads to the conclusion that the efficiency of the forecasts generated by these models in the individual trials was varied. This means that none of these systems can be considered to work best in conditions prevalent in Lithuania. It should also be noted that these studies were carried out on the basis of companies from different sectors and the sample size in some cases was very small. Most probably the scientist who in 2003 was the first to build a model based on Lithuanian enterprises is Grigaravičius (2003). To do this, he used the logit method with a sample of 88 entities. The estimates of other models dedicated to the Lithuanian market were provided by Purvinis et al. (2005a and 2005b). They used the technique of linear multivariate discriminant analysis and artificial neural networks with the learning sample consisting of only 13 companies. In 2008, the same authors presented hybrid models combining the technologies of artificial neural networks and fuzzy logic (Purvinis et al., 2008). In this case, the study sample was larger and comprised of

² For more on this topic, see e.g. Korol (2010; 2013).

³ See Republic of Lithuania, Law of Enterprise Bankruptcy, <http://www.litlex.lt/litlex/eng/frames/laws/Documents/21.HTM> (20.07.2016) and J. Spaičienė (2008).

30 healthy and 200 bankrupt companies. Their best performance model allowed them to obtain, based on a validation sample, the first degree efficiency of slightly more than 80%, which was still higher by 7 percentage points than the result obtained using the Altman's model. In 2006, on the basis of 56 companies, Stundžienė and Boguslauskas (2006) developed a model for assessing the risk of bankruptcy using cluster analysis. It ensured higher efficiency in relation to the Altman's one. In the same period Merkevičius et al. (2006) modified, by using the technique of self-organizing maps, the weights in Altman's model so as to better adapt it to the conditions prevalent in Lithuania. Two years ago Butkus et al. (2014) built a number of models using the logit method. It is noteworthy that they had a sectoral nature (related to construction, trading, service and industrial companies) and were supplemented by additional models estimated for enterprises of various sizes. The last of the available models was developed by Šlefendorfas (2016). The author used a sample of 145 enterprises for this purpose and method of the linear multivariate discriminant analysis. The efficiency determined for learning sample was 89%.

Table 1: Summary of research on the prediction of corporate bankruptcy in Lithuania

Models	Traditional multi-dimensional foreign models of enterprise bankruptcy forecasting	Other modern models of forecasting bankruptcy of enterprises, including those built using the sample of Lithuanian businesses
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Research
authors

	Two-factor ⁰	Altman ¹	Altman ²	Altman ³	Altman ⁴	Taffler & Tishaw	Springate	Lis	Fulmer	Zavgren	Chesser	Ca-Score	Seifulin & Kadykov
Mackevičius, Poškaitė – 1999		X											
Tvaronavičienė – 2001		X											
Grigaravičius – 2003													X ¹
Grigaliūnienė, Cibulskienė – 2004	X		X	X	X	X	X		X			X	
Mackevičius, Rakšteliene – 2005		X	X	X	X								
Purvinis, ˇSukys, Virbickaitė -2005		X				X	X						X ²
Purvinis, ˇSukys, Virbickaitė -2005													X ³
Mackevičius, Silvanavičiūtė -2006		X				X	X			X	X		
Merkevicius, Garšva, Girdzijauskas – 2006													X ⁴
Nedzveckas, Jurkevičius, Rasimavičius – 2006	X	X					X						X
Stundžienė, Boguslauskas – 2006		X											X ⁵
Stoškus, Beržinskienė, Virbickaitė - 2007													X ⁶
Garškaitė – 2008	X	X	X			X	X	X					
Kanapickienė, Rudžionienė, Griauslytė -2008		X				X	X			X	X		X ⁷
Purvinis, Virbickaitė, ˇSukys – 2008		X											X ⁸
Karalevičienė, Bužinskienė -2012													X
Budrikienė, Paliulytė – 2012		X				X	X	X		X	X		X ⁹
Kiyak, Labanauskaitė – 2012			X				X			X	X		
Jurevičienė, Bercevič - 2013			X			X	X	X		X	X		

In Poland in the postwar period a bankruptcy and reorganization law was in force, supplemented by appropriate ministerial ordinances⁴. Due to the nature of the economic system, however, it was dead. Upon the commencement of economic transformation, the first corporate bankruptcies took place in 1990. In 2003, the new bankruptcy law was introduced, which, with later amendments, is still in force⁵. On 1 January 2016, it was supplemented by new restructuring law⁶. The problems of forecasting corporate bankruptcies in Poland has been of interest to the researchers only since mid-1990s, although it must be said that since then the number of studies dealing with this issue has been very significant. For this reason, below only an overview of the most important literature on this topic is presented. The pioneering research was aimed at using foreign models, particularly the Altman model, to predict bankruptcies of Polish enterprises (Mączyńska, 1994; Gasza, 1997; Łukaszewski and Dąbroś, 1998; Bławat, 1999; Zdyb, 2001). Zdyb (2001) proposed i.a. adjusting the cut-off point in Altman's model to Polish conditions, so that it generates more efficiency. In the similar period the Polish researchers also started using the ratio analysis (Wędzki, 2000; Stępień and Strąk, 2003; Michaluk, 2003; Kniewski, 2004; Prusak, 2005), as well as building first models allowing for predicting corporate bankruptcies (Pogodzińska and Sojak, 1995; Gajdka and Stos 1999; Hadasik, 1998; Wierzba, 2000). Due to the limited access to or scarcity of data, these models were created using small samples and based on multivariate linear discriminant analysis. Later, a number of other models were created using the same statistical technique and the sizes of learning samples were mostly higher (Hołda, 2001; Sojak and Stawicki, 2001; Mączyńska, 2004, Appenzeller and Szarzec, 2004; Michaluk, 2004; Korol, 2004; Hamrol et al., 2004; Prusak, 2005; Siudek, 2005; Jagiełło, 2013; Juszczuk and Balina, 2014). As in the developed countries, newer statistical techniques also began to be used, such as the logit method (Gruszczyński, 2003; Michaluk, 2003; Wędzki, 2004; Stępień and Strąk, 2004; Prusak and Więckowska, 2007; Jagiełło, 2013; Piśuła et al., 2013; Pocięcha et al., 2014), artificial neural networks, genetic algorithms or classification trees (Michaluk, 2003; Korol, 2004; Piśuła et al., 2013; Pocięcha et al., 2014). Korol (2010b) also applied the method of support vectors and fuzzy logic. It is worth noting that in addition to universal models many sectoral models were created, dedicated to i.a.

- transport, construction, service, trading and industrial companies (Jagiełło, 2013),
- shipping companies (Juszczuk and Balin; 2009), or
- cooperative banks (Siudek 2005).

Conclusions

In the area of forecasting corporate bankruptcy there are both similarities and differences between the analysed countries. The former include i.a.:

⁴ Rozporządzenie Prezydenta Rzeczypospolitej z dnia 24 października 1934 r. Prawo upadłościowe, Dziennik Ustaw 1934 no. 93 item 834 and Rozporządzenie Prezydenta Rzeczypospolitej z dnia 24 października 1934 r. Prawo o postępowaniu układowym, Dziennik Ustaw 1934 no. 93 item 836.

⁵ Ustawa z dnia 28 lutego 2003 r. Prawo upadłościowe i naprawcze, Dziennik Ustaw 2003 no. 60 item 535, as amended.

⁶ Ustawa z dnia 15 maja 2015 r. - Prawo restrukturyzacyjne, Dziennik Ustaw 2015 item 978.

- the beginnings of interest in this subject dating back to 1990s, which is a consequence of the development of the institutional order adapted to the functioning of market economies and at the same time the emergence of the actual corporate bankruptcies;
- the first studies, which consisted in adapting foreign models to predicting the bankruptcy of domestic enterprises, and the fact that, with the emergence of enough data related to bankrupt entities, local researchers started to create national models.

On the other hand, some differences relate to the following issues:

- in Poland, a tendency to resign from using foreign models to predict the bankruptcies of domestic entities is observed, while in Lithuania such analyses are still considered valid;
- in Lithuania, in comparison to Poland, only few domestic models were estimated — moreover, they were based on rather traditional statistical techniques. There are also much fewer sectoral models. This may be due to differences in size of the two countries, which has an impact on the number of operating business entities and at the same time the number of researchers.

In comparison to the developed countries, it can be seen that the state and the advancement of research on issues of corporate bankruptcy in Poland and Lithuania does not differ from them significantly. It is obvious that due to considerations related to the nature of economic systems the interest in this issue emerged later than e.g. in the United States and the demand for this type of studies is much smaller. The review of global research in the field of forecasting corporate bankruptcy in the Google Scholar database allows for observing that the field is dominated by analyses of comparative effectiveness of different statistical techniques and the introduction of newer and newer mathematical solutions. Against this background, Poland performs better than Lithuania. Moreover, in the case of Lithuania building sectoral models seems recommended, of course subject to availability of data, as well as resigning from the use of foreign models to evaluate domestic enterprises. In addition, it is recommended to introduce into the models used not only variables such as financial indicators but also other economic measures, reflecting e.g. economic situation, competitiveness of entities, volatility of financial results etc. (Prusak, 2005, pp. 20-27). While in Poland such attempts have already been made (Korol, 2010a, Korol, 2008), in Lithuania the traditional approach based solely on financial indicators continues to dominate.

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