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USE OF POLISH DISCRIMINATION MODELS IN THE ASSESSMENT OF BANKRUPTCY RISK IN CHOSEN MEAT PROCESSING COMPANIES
ИЗПОЛЗВАНЕ НА ПОЛСКИ МОДЕЛИ НА ДИСКРИМИНАЦИЯ В ОЦЕНКА НА РИСКА ОТ БАНКРУТ В ИЗБРАНИ ПРЕРАБОТВАТЕЛНИ КОМПАНИИ ЗА МЕСО

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Abstract

The aim of the study is to assess the bankruptcy risk of selected meat processing enterprises, such as: *Indykpol SA*, *Pamapol SA* and *Tarczyński SA*. For the analysis, 450 financial data were collected and used in the models. The main criteria for the selection of the companies for testing were as follows: carrying out the main business in the area of meat processing, legal status: limited liability company, employment of more than 50 people and availability of financial data. The analysis showed that all surveyed companies were in a very good financial situation. *Pamapol SA* faced the greatest threat of bankruptcy in 2008–2009 and 2012–2013. Extremely sensitive to the deteriorating situation, and thus to the most common threat of bankruptcy, proved to be the *D. Wierzby* model in 2009 for all companies, and only for *Pamapol SA* in 2008 and in 2009 (after the *D. Hadasik* model).

Key words: assessment of enterprise's bankruptcy risk, discrimination analysis, meat processing enterprises, Poland.

INTRODUCTION

Polish meat sector has both a high potential and position compared to other branches of the Polish economy. Actors on this market operate with a high exposure to risk, including economic and production risk. In Poland, the phenomenon of involuntary bankruptcy as a way to stop the economic activity did not occur until 1989 because the courts had not recorded the cases of bankruptcy (Cubała, 1996). Bankruptcy as an important part of economic life appeared after 1989, with the liberalization of the economic life.

Many of the authors (Altman, 1983; Antonowicz, 2006, 2007, 2010; Gajdka and Stos, 1996; Grzegorzewska, 2008; Hamrol et al., 2004; Kitowski, 2012; Mączyńska, 2004; Wierzba, 2000) who research on bankruptcy confirm that bankruptcy does not appear suddenly, and some of the symptoms can be detected well in advance, giving a chance to take corrective action. One of the most important decisions made by the business board is to create a structure with respect to foreign equity. In the shortterm introduction of foreign companies funding is intended to allow financing of investments which would not be possible without additional funding. On the other hand, the long-term extern sources of funding for increased earnings per unit of invested equity capital result in the so called financial leverage. If the company does not yield the expected profit, it is faced with difficulties handling financial obligations.

In a market economy a basic scientifically proved objective for the proper functioning and development of enterprises is to maintain financial liquidity, which is understood as the absence of a company's ability to purchase goods and services needed to meet its production needs, as well as the lack of ability to pay any financial obligations in full and within the applicable time limits (Hill and Sartoris, 1995; Kulawik, 1992; Michalski, 2005).

The experimental hypothesis of the paper is that an examined enterprise can be predicted as bankrupt or not with a help of a few high efficiency Polish discrimination models. To the article the mo-dels developed by researchers at the Institute of Economics of the Polish Academy of Sciences, edited by E. Mączyńska called the INE 6 model as well as the INE 7 model, the Hadasik model, the Poznański model, the Czajka and Piechocki model, the Wierzby model were taken. The choice of models for discrimination analysis was made on the basis of the criterion of maximum average overall efficiency, received by 36 Polish and 16 foreign corporate bankruptcy prediction models [Antonowicz, 2007] in 2002–2006.

MATERIALS AND METHODS

In Poland, according to the Coface Report 3 which covers the period from 1997–2008, there was a systematic increase in the number of declarations of bankruptcy from 794 to 1 863 in 1997–2002, with the exception of 2003 (1798), and after 2003 there was a further increase from 1 798 to 4 011 in 2008. Since 2009, the number of bankrupt companies in the Polish economy remains relatively constant, although it is still high. In 2011, the courts declared bankruptcy of 723 Polish companies, while in 2012 there were 877 entities which went into liquidation, which is an increase of over 21% compared to 2011. By analyzing bankruptcy from the point of view of legal forms in 2008–2013 the largest number of companies that went bankrupt were limited liability companies and sole traders.

At the core of forecasting models most frequently used in practice, lies the assumption that at any given time operating companies fall into one of two separate research groups: companies "in good financial condition" and those "in poor financial condition". The construction of the prediction models and forecasting of bankruptcy is based on information characterizing the current economic and financial situation of the entities, so the results relate to a possible bankruptcy in a one year period. Methods used for assessing the financial condition of enterprises belong to the group of dynamic financial analysis, which task is to give a full, multidimensional view on the operating status of the entity. Unfortunately, the undoubted disadvantage of these met-hods is that they do not contain variables, such as the qualifications of the management or the position of the company on the market. In addition, one of the major difficulties of application of indicatory analysis is determining the reference point for the surveyed companies, as it has a decisive influence on the assessment, postulated conclusions and proposed solutions for their further action.

The first studied model is the INE 6 model, which was created as a result of the analysis of financial statements of 80 companies listed on the Warsaw Stock Exchange in 1997-2001. The critical value of the INE 6 model is zero, which means that those companies who have reached value below zero were classified to the group with „poor financial condition," and those above - "good financial condition." The INE 6 model is characterized by efficiency of 94.20% [Antonowicz, 2007] and it is described by the formula [Mączyńska, 2004]:

Z 6 = 9,478 * B 1 + 3,613 * B 2 + 3,246 * B 3 + 0,455 * B 4 + 0,802 * B 5 - 2,478

where:

B 1 - operating profit/assets,

B 2 - equity/assets,

B 3 - (net profit + depreciation)/total liabilities,

B 4 - turnover assets/liabilities,

B 5 - sales revenues/assets.

The INE 7 model is described by the formula [Mączyńska, 2004]:

Z 7 = 9,498 * B 1 + 3,566 * B 2 + 2,903 * B 3 + 0,452 * B 4 - 1,4987

where:

B 1 - operating profit/assets,

B 2 - equity/assets,

B 3 - (net profit + depreciation)/total liabilities,

B 4 - turnover assets / current liabilities.

The critical value of the INE 7 model is zero, which means that those companies who have reached value below zero were classified to the population with "poor financial condition," and those above – the population with "good financial condition." The INE 7 model is characterized by the highest efficiency equaling 94,82%.

The third model by D. Hadasik was built on the basis of the analysis of 61 companies belonging to the group of non-threatened by bankruptcy (39) and those which failed (22) and in the period from 1991 to 1997 submitted an application for bankruptcy in regional court in Poznan, Pila and Leszno. The boundary value is zero. The entities analyzed with discrimination models are characterized by different ownership structure. Most of them were state enterprises, limited liability companies, joint stock companies and cooperatives. The D. Hadasik model is characterized by the efficiency of 95,08%, and in a study conducted by a team of M. Hamrol and J. Chodakowski of 57.6%. The Hadasik model is described by the formula [Hamrol, Chodakowski, 2008]:

Z H = 2,362 + 0,365 * B 1 – 0,765 * B 2 – 2,404 * B 3 + 1,590 * B 4 + 0,002 * B 5 – 0,012 * B 6

where:

B 1 - current assets/current liabilities,

B 2 - (current assets - inventory)/current liabilities,

B 3 - total liabilities/total assets

B 4 - (current assets - current liabilities)/ total liabilities,

B 5 - receivables/sales revenues,

B 6 - inventory/sales revenues.

The fourth model called "poznański" is described by the formula [Hamrol et al., 2004]:

Z POZ = 3,562 * B 1 + 1,588 * B 2 +4,288 * B 3 + 6,719 * B 4 - 2,368

where:

B 1 - net profit/total assets,

B 2 - (turnover assets - inventories)/ current liabilities,

B 3 - permanent capital/total assets,

B 4 - profit from sales/revenue from sales.

The critical value of the "poznański" model is zero. This model was based on the analysis of financial statements of 100 Polish commercial law companies in 1999-2002, where a half of the surveyed companies belonged to a group not threatened by bankruptcy, the so called "healthy companies". Selection of healthy entities was made according to the size of their assets. The Poznań model stood out with the efficiency of 96%.

The fifth model by D. Wierzba is described by the formula [Wierzba, 2000]:

Z W = 3,26 * B 1 + 2,16 * B 2 + 0,3 * B 3 + 0,69 * B 4

where:

B 1 - (operating profit - depreciation)/total assets,

B 2 - (operating profit - depreciation)/ revenue from sales of products,

B 3 - turnover assets/total liabilities,

B 4 - turnover assets/total assets.

The critical value in the D. Wierzby model is zero. The companies for which the value of the discrimination function is a negative number are considered to be at risk of bankruptcy, whereas companies with a positive number – are considered not to be at risk of bankruptcy. Financial data of 24 enterprises was used for the model. The group of companies at risk consisted of those which were declared bankrupt by the ruling of the Commercial Court in 1995-1998 began composition proceedings. The model is characterized by the efficiency of 92%.

RESULTS AND DISCUSSION

It can be noticed from the data in table 1 that in 2013 all the analyzed companies employed a similar number of employees – 991 people in Pamapol SA, 1016 people in Tarczyński SA up to 1168 people in Indykpol SA. In 2013 the recorded total value of the sales revenue ranged from 457 892 thousand PLN in Pamapol SA., 462 128 thousand PLN in Tarczyński S.A. up to 1.006 330 thousand PLN in Indykpol SA. The analyzed companies are among the largest domestic producers and processors of red meat (Pamapol SA, Tarczyński SA) and white meat (Indykpol SA) and all are characterized by a high level of income derived from sales of products, goods and services in general, as well as the high number of employees.

The analysis carried out with the use of the INE PAN 6 model and INE PAN 7 model shows that in the period from 2005 to 2013 all three meat processing enterprises were in good financial situation (table 2). In all analyzed years Indykpol SA, Tarczyński SA reached the highest positive values exceeding the critical value of zero with the exception of two companies in the particular time period. In 2013 Pamapol SA reported a negative value for the INE 6 model (-0,59) and INE 7 model (-0,72) as well as in 2008 only for the INE 7 model (0,20).

In the INE 6 model Indykpol SA indicates values from 1.43 (2013) to 5.93 (2007) and the INE 7 model shows values of this function at the level of 0.54 (2013) to 2.90 (2007), which means that in both cases the generated results indicated a good financial condition of the Indykpol company.

In the INE 6 model Pamapol SA indicates positive values of the discrimination function which oscillated at a high level of 0,33 (2012) to 6,22 (2006), with the exception of 2013 (-0.59). The INE 7 model reported positive values varying from 0,22 (2012) to 2,42 (2006), which means that Pamapol SA was not in danger of bankruptcy, with the exception of 2008 (-0,20) and 2013 (-0,72), which in both cases showed negative value.

In the INE 6 model Tarczyński SA indicates high positive values ranging from 0,82 (2013) to 4,07 (2005). The INE 7 model reported stable high values ranging from 0,60 (2013) to 3,13 (2005), which means that neither model qualified Tarczyński SA as a company threatened by bankruptcy.

Table 1. Characteristic of research units in 2013

Company name	Legal form	Number of employees (persons)	Revenues from sales (thousand PLN)
Indykpol	limited company	1168	1.006 330
Pamapol		991	457 892
Tarczyński		1016	462 128

Source: own research based on data from Monitory Polskie B in 2013 and www.money.pl.

Table 2. The results of the discrimination models for the analyzed enterprises in 2005-2013

Model	Indykpol SA								
	2005	2006	2007	2008	2009	2010	2011	2012	2013
INE PAN (6)	3,24	4,50	5,93	2,77	4,06	2,11	1,49	1,45	1,43
INE PAN (7)	2,40	2,15	2,90	0,66	1,61	1,45	0,86	0,67	0,54
Hadasik	1,43	1,72	2,17	1,17	1,19	1,17	0,86	1,09	0,68
Poznański	3,20	1,56	2,31	1,96	2,59	4,48	3,09	2,17	1,99
Wierzby	0,12	0,24	0,53	-0,13	0,20	-0,09	-0,05	-0,08	-0,11
Model	Pamapol SA								
	2005	2006	2007	2008	2009	2010	2011	2012	2013
INE PAN (6)	1,41	6,22	2,77	0,79	3,22	1,70	1,21	0,33	-0,59
INE PAN (7)	1,82	2,42	1,37	-0,20	1,31	1,88	1,40	0,22	-0,72
Hadasik	1,85	1,89	0,95	-2,12	-2,01	1,40	1,40	0,56	0,44
Poznański	1,14	3,98	2,11	2,52	2,61	2,37	2,13	0,25	-0,07
Wierzby	0,10	0,57	0,11	-1,26	-0,63	0,24	0,08	-0,04	-0,51
Model	Tarczyński SA								
	2005	2006	2007	2008	2009	2010	2011	2012	2013
INE PAN (6)	4,07	1,88	0,98	1,17	2,25	2,34	1,14	1,12	0,82
INE PAN (7)	3,13	1,52	0,90	0,97	1,78	2,07	0,91	0,67	0,60
Hadasik	1,26	0,53	0,80	0,83	0,93	1,09	0,89	0,48	0,69
Poznański	2,54	1,82	1,88	1,56	1,90	2,40	1,52	1,10	1,26
Wierzby	0,08	-0,24	-0,50	-0,45	-0,09	0,01	-0,15	-0,37	-0,34

Source: own research based on the financial data of the analyzed meat processing enterprises.

For all analyzed companies in the period 2005-2013 the Hadasik model shows positive values, except for Pamapol SA in 2008 (-2,12) and 2009 (-2,01). Indykpol SA received the highest positive values indicating good financial condition occurring at the level of 0,68 (2013) to 2,17 (2007); in Pamapol SA at the level of 0,44 (2013) to 1,89 (2006), and in Tarczyński SA at the level of 0,48 (2012) to 1,26 (2005).

In the period 2005-2013 the poznański model reported positive values in all four enterprises, which means that all studied units were healthy and "they were not at risk of bankruptcy." The highest positive values of the discrimination function was noted in the Indykpol SA company from the level of 1,56 (2006) to 4,48 (2010), Tarczyński SA from the level of 1,10 (2012) to 2,54 (2005) and Pamapol SA from the level of 0,25 (2012) to 3,98 (2006), except for 2013 (-0,07).

The Wierzby model revealed for Indykpol SA, Pamapol SA and Tarczyński SA as many positive as negative values. In Indykpol SA one could note positive function values from 0,12 (2005) to 0,53 (2007), in Pamapol SA from 0,08 (2011) to 0,57 (2006), in Tarczyński SA from 0,01 (2010) to 0,08 (2005). In 2008-2009 and 2012-2013 the Wierzby model pointed out that all investigated companies could have become bankrupt (see table 2).

In the period 2005-2013 the results of all five models used to analyze Indykpol SA classified the companies as non-threatened by bankruptcy, except for the Wierzby model. The values of the Wierzby model were considerably below the reference limit for Indykpol SA in 2008 (-0,13), 2010 (-0,09), 2011 (- 0,05), 2012 (-0,08) and 2013 (-0,11). The Pamapol SA was in good financial condition, not threatened by bankruptcy, except for 2008-2009 and 2012-2013. In 2008, three out of the five models signaled the threat of bankruptcy for Pamapol SA, which were: the INE PAN 7 model with a negative value of 0,20, the Hadasik model (-2,12), the Wierzby model (-1,26), in 2009 the Hadasik model (-2,01) and the Wierzby model (- 0,63). In 2012 the Wierzby model indicated bankruptcy risk (-0,04). Conversely, in 2013, four of the five models pointed to the threat of bankruptcy of the company, except the Hadasik model(0,44). For Tarczyński SA, all five models showed no threat of bankruptcy, except the Wierzby model in: 2006 (-0,24), 2007 (-0,50), 2008 (-0,45), 2009 (-0,09) 2011 (-0,15), 2012 (-0,37) and in 2013 (-0,34).

CONCLUSIONS

Analyzing the outcome values of early warning models for these three enterprises it can be said that the meat processing companies were in a very good financial situation and far from bankruptcy. The most difficult financial situation and, consequently, the greatest risk of bankruptcy, was faced by Pamapol SA in 2008–2009 and 2012–2013. The following models proved to be particularly sensitive to the deteriorating situation of the surveyed companies, and thus the most common risk of bankruptcy: the D. Wierzby model (for most companies), models INE PAN 6 and INE PAN 7 (for two companies), the D. Hadasik model (for one company).

The use of discrimination analysis models to assess the risk of bankruptcy of enterprises is a helpful, frequently used and valuable tool for decision-making processes in the face of a real threat of insolvency of operators exante. However they are not universal methods. Sometimes, they are subject to simplification, misinterpretation, may also contain some factual errors resulting from the adoption of certain methodological assumptions without reference to their source (Kitowski, 2013a; Kitowski, 2013b). The use of discrimination methods depends on the type, size, industry-specific, location of businesses, as well as other conditions (Korol, 2010; Mączyńska and Zawadzki, 2006; Rogowski, 2008; Wardzińska, 2012). Unfortunately, relying solely on financial data does not take into account the impact of variables such as: qualified executives, the company's market position. Second major difficulty of the use of the indicatory analysis is to determine the reference point for the companies investigated, which has a decisive influence on the assessment and proposed solutions for their further action. In addition, the period of maintaining the credibility of the predictive model is conditioned by the existing economic situation, but no longer than ten years since its inception (compare with: Korol, 2010; Gołębiowski and Tłaczała, 2005)

The discriminatory models based on the historical financial information do not take into account the specific circumstances of the company, industry or market, which have an impact on the level of results reliability. There is a need to formulate national discriminatory models for various industries and companies. Researchers are still looking for met-hods of financial risk detection well in advance in order to take certain preventive measures.

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