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SELECTED METHODS OF CORPORATE BANKRUPTCY RISK ASSESSMENT – THE CASES OF THE POLISH CHOSEN MEAT SECTOR COMPANIES

WYBRANE METODY OCENY RYZYKA BANKRUCTWA NA PODSTAWIE PRZEDSIĘBIORSTW BRANŻY MIĘSNEJ

Key words: bankruptcy, risk assessment, forecasting
Słowa kluczowe: bankructwo, ocena ryzyka, prognozowanie

Abstract. Thanks to the tools and methods used nowadays in the financial sector, management of an enterprise in not only aware of the financial performance but is also able to assess the risks by which the company is threatened and thus prepare for necessary changes. The paper main purpose was to describe and apply the commonly used tools of the bankruptcy risk assessing. The methods were applied on four companies of the polish meat sector. Two of them went bankrupt in 2012 and other two are still operating. The paper indicates both advantages and limitations of the methods used.

Introduction

Charting the process of the business is very important in present, saturated market. Financial analysis of the statements is a tool which enables recognizing not only financial performance but also the relations between decisions and their results, realization of the goals set. It points areas on which special attention should be paid and facilitates making decisions.

Thanks to available models of discriminant analysis, assessment of the bankruptcy risk is possible. However, bankruptcy prediction is a very complex issue. Discriminant analysis models used to distress prediction have their limitations. They tend to be sensitive to time periods, market conditions diversity and various bankruptcy reasons. That is why it is so important to apply models in appropriate way. When focusing on Poland, models elaborated in other countries normally should not be applied on the polish market. Polish food industry and especially meat industry, which is subject of this paper, is characterized by various factors distinguishing it from other industries, such as low profitability. These conditions should be taken into account while assessing the default risk.

Theoretical background

The first studies of bankruptcy prediction were conducted in 30s of 20th century in United States. There were no statistical methods used in that time, values of financial ratios of bankrupt and non-bankrupt companies were being compared.

Later, in 1968, Altman expanded method used by Beaver to multivariate discriminant analysis (MDA). In 80s of 20th century logistic analysis (logit regression – LR) was presented by another pioneer of the financial failure empirical approach, James Ohlson. Both Altman and Ohlson methods are basically linear models classifying companies as non-failed or failed on the basis of financial ratios. LR was the most used statistical method for bankruptcy prediction until last years [Gepp, Kumar 2008].

Financial ratios are method often used in Poland to assess a risk of default of a company. In order to do that, a statistical relationship between values of financial ratios and bankruptcy is established. There were various researches carried out in Poland in this area, the first one basing on 12 enterprises which went bankrupt in 1997 by Wędzki [2000]. Other researches were conducted by Stępień and Strąk [2003] who based on 528 companies to which bankruptcy application was submitted in 1996-2000. Nevertheless these researches omitted comparing healthy companies to bankrupt companies. One of the most recent

researches are the ones conducted by the company Havis Polska which divided the sample of the companies according to their sector but by results did not directly classify as bankrupt or healthy [Kaniewski 2004].

When it comes to the methodology, the discrimination analysis is the most popular among finance researchers on Polish financial distress. Other approaches use logit and probit models, of binomial and multinomial type or neural networks.

Material and methods

The main purpose of the paper was models of discriminant analysis functions implementation while assessing the bankruptcy risk. In this paper the companies from meat manufacturing sector are analyzed. Authors of the paper tested the following hypothesis: Models elaborated for concrete sector give more accurate results than the general ones.

Seven discriminant models were created and evaluated in Polish Academy of Science (PAN) by Mączyńska and Zawadzki [2006] basing on the polish companies from various sectors. Ratios used in these models along with their weights and definitions were presented both in table 1 and 2.

Table 1. Ratios of estimated models and their weights
Tabela 1. Wskaźniki oszacowanych modeli i ich wagi

Ratios (x)/ *Wskaźniki (x)*	Model/*Model*						
	A	B	C	D	E	F	G
	weights of the ratios (w)/ *wagi wskaźników (w)*						
II	5,577	5,837	5,896	6,029			
OROA	1,427	2,231	2,831	6,546	9,004	9,478	9,498
ROS	0,154	0,222					
AROA	0,310	0,496					
EC/A	1,937	0,945	0,539	1,546	1,177	3,613	3,566
(EC-IC)/A	1,598	2,028	2,538	1,463	1,889		
BP	3,203	3,472	3,655	3,585	3,134	3,246	2,903
OR/C	0,436	0,495	0,467				
CR	0,192	0,166	0,179	0,363	0,500	0,455	0,452
WC/NCA	0,140	0,195	0,226	0,172	0,160		
SI/A	0,386	0,030	0,168	0,114	0,749	0,802	
Log A	1,715						
Const (w_0)	-9,832	-0,392	-0,678	-0,593	-1,962	-2,478	-1,498

Source/*Źródło*: Mączyńska, Zawadzki 2006

A discriminant function estimated in each model (function *Z*) is a sum of products of *x* and weights of the ratios (*w*). It is calculated as follows:

$$Z = w_1 \cdot x_1 + w_2 \cdot x_2 + \ldots \ldots w_n \cdot x_n + w_0$$

The higher the value of the function is, the lower risk of bankruptcy and vice versa. Negative number in relation to "healthy" companies and positive in relation to bankrupt companies means misclassification. The accuracy of the models was estimated to 88%.

Hołda elaborated discriminant and logit models for companies from manufacturing sector, construction industry and commercial sector. Model for manufacturing sector variant has the following form [za Kitowski 2012]:

$$Z = 0.073 + 4.015 \cdot W_1 + 0.587 \cdot W_2 - 0.78 \cdot W_3$$

where:
W_1 = profit(loss) on sales/net revenue on sales,
W_2 = current assets/ short-term liabilities,
W_3 = liabilities and provisions for liabilities/assets.

Table 2. Definitions of the discriminant function ratios
Tabela 2. Definicje wskaźników funkcji dyskryminacyjnej

Ratio/*Wskaźnik*	Symbol/*Oznaczenie wskaźnika*	Numerator/*Licznik*	Denominator/*Mianownik*
The rate of income increase/*Stopa wzrostu przychodów*	II	Sales income/ *Przychody ze sprzedaży*	Previous year sales income/*Przychody za rok poprzedni*
Operating return on assets/*Rentowność operacyjna aktywów*	OROA	Operating result/*Wynik operacyjny*	Total Assets/*Aktywa ogółem*
Return on sales/*Rentowność netto przychodów*	ROS	Net profit/ loss/*Wynik finansowy netto*	Sales income/*Przychody ze sprz.*
Gross accumulated return on assets/ *Skumulowana rentowność brutto aktywów*	AROA	Accumulated financial result for 3 years/*Wynik finansowy brutto* (skumulowany za 3 lata)	Total Asset/ *Aktywa ogółem*
Gross self-financing margin/*Udział kapitału własnego w finansowaniu aktywów (wskaźnik samofinansowania)*	EC/A	Equity capital/*Kapitał własny*	Total Assets/ *Aktywa ogółem*
The share of equity in financing of fixed asstes/*Skorygowany wskaźnik udziału kapitału własnego w finansowaniu aktywów*	(EC-IC)/A	Equity capital – initial capital/ *Kapitał własny minus kapitał zakładowy*	Total Assets/ *Aktywa ogółem*
Borrowing power/*Zdolność do spłaty zadłużenia*	BP	Net profit/loss + depreciation/ *Wynik finansowy netto/plus amortyzacja*	Total Liabilities/ *Zobowiązania ogółem*
Coverage of the financial costs/ *Pokrycie kosztów finansowych*	OR/C	Operating result/ *Wynik operacyjny*	Financial costs/ *Koszty finansowe*
Current ratio/*Płynność bieżąca*	CR	Current assests/ *Aktywa obrotowe*	Current liabilities/*Zob. krótkoterm.*
Working capital to non-current assets/*Relacja kapitału obrotowego do majątku trwałego*	WC/NCA	Working capital/ *Kapitał obrotowy*	Fixed assets/ *Majątek trwały*
Productiveness of assets/*Produktywność aktywów*	SI/A	Sales income/ *Przychody ze sprzedaży*	Total Assets/ *Aktywa ogółem*
Absolute asstes value/*Względna wielkość aktywów*	Log A	Logarithm of assets value/ *Logarytm dziesiętny wartości aktywów*	

Source/*Źródło*: Mączyńska, Zawadzki 2006

According to the author's interpretation, companies which discriminant function has values higher than 0 do not face the risk of bankruptcy. Values lower than 0 are a sign of default risk. Financial indicators vary from industry to industry; the ratios can only be interpreted when compared and contrasted with other companies in that industry.

Brief overview of the polish meat industry and studied companies

The food manufacturing sector is the largest manufacturing sector in Poland. It has a share of 17% of employees and 18% of turnover in the industry. It is based on large agricultural production – Poland is among the European Union countries with the largest agricultural population. Within the food manufacturing industry, the meat sector employs almost 30% of all employees and has 24% of the total turnover [*Study on the competitiveness…2011*].

Polish meat industry characterizes low concentration of production. Low production concentration is typical for the Polish meat sector, which makes it highly competitive. Competition may lower prices and profitability. Difficult situation of the meat sector is also the result of the transition period (ended in 2009), during which Polish enterprises were required to undertake measures to meet the EU standards. Adjustments led to substantial investment outlays. These factors make enterprises exposed to the risk of bankruptcy. Meat production companies are among the sectors with the highest risk of bankruptcy. Between January 2008 and January 2012, approximately 200 companies suspended or ceased production [Boratyńska 2012].

In the paper four polish meat sector companies are described and analysed. All of them are, or where until the recent time, stock companies. Two of them, Zakłady Mięsne Herman Sp. z o.o. and Indykpol S.A., are still operating at the market. The two other companies went bankrupt in 2012 (PMB Białystok S.A. and Polski Przemysł Mięsny i Drobiarski MAT S.A.).

The empirical study results

There were considerable limitations when it comes to the empirical data analyzed. The most problematic companies from the data availability point of view were the bankrupt companies. Both of them went bankrupt in 2012. While PMB Białystok S.A. submitted all the financial statements until the end of 2011, in case of MAT S.A., the financial statement of December 2010 was the last one which the company filed. In order to consider a homogenous data coming from the same period of a time for each company, the data from 2006 to 2010 are presented.

A problem of assessing the bankruptcy risk was analyzed using discriminant models. As models often used for polish market giving good results, models of Mączyńska and Zawadzki were selected. Two from among seven of the models were applied in four companies in 2006-2010, model A and G. Financial ratios used in the models were calculated and further the Z-function values were estimated.

As an alternative method for the ones of Mączyńska and Zawadzk, discriminant model of Hołda elaborated for the manufacturing sector companies was applied. Results of three models were compared and analyzed. As the last step, default risk for all companies was enclosed on one graph for each model in order to illustrate the general effect.

At the end all four companies results of each model were enclosed in one graph for each method. On the below graph (fig. 1) results of Model A of Mączyńska and Zawadzki are illustrated for Indykpol, Herman, MAT and PMB.

While observing the dynamics of default risk according to the Mączyńska and Zawadzki Model A, Indykpol results are the best from default risk point of view. The company does not face that risk in the period 2006-2010, resulting with positive values of the dicsriminant function. Herman seems to face the highest bankruptcy risk among the analyzed companies. In 2007 financial situation of Herman got worse and it started to have negative values of the Z-function from 2008 which were maintained till 2010. MAT is not facing the bankruptcy risk according to this model as the values of the function do not exceed the critical limit of 0 and PMB started to be threatened with default risk in 2010 (fig. 1).

In case of Mączyńska and Zawadzki Model G results we observe a smaller distance between the values however the general outlook of the bankruptcy risk for each company is similar. Indykpol is not threatened with bankruptcy having strong positive results. Herman's results started to deteriorate from 2007 and in the period 2008-2010 model is reflecting the default risk however in 2010 that risk decreased. MAT, as in the previous model, seems to not face the bankruptcy risk, nevertheless the function value decrease in 2010 and the trend may indicate possibility of being threatened with such risk in the future. PMB is representing the lowest function values at the beginning of the period observed and in 2010 value exceeded the default risk limit (fig. 2).

Hołda model gives the highest values of the discriminant function among the three model applied. According to this method, none of the companies is threatened with bankruptcy until 2010 when PMB slightly exceeded the risk limit with negative value of -0,01. What distinguishes the models results from results of previously described methods is also the assessment of MAT situation. The company accordingly to Hołda model has the lowest discriminant function values among the analyzed entities. In 2008 it was close to the critical limit of default risk and in 2010 it decreased again what should be a reason for the company's management to carry out a thorough observation of the financial results and processes. Herman, on the contrary, seems to not face a default risk at any time of the analyzed period (fig. 3).
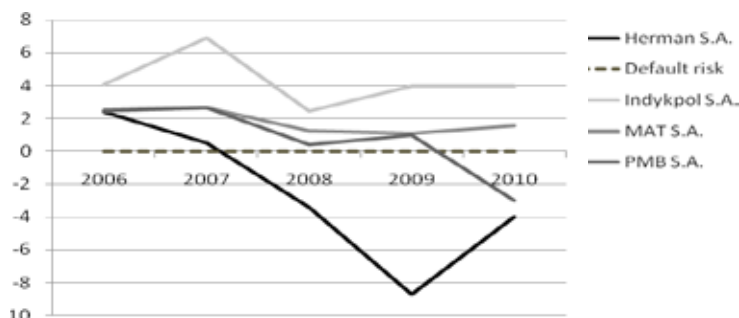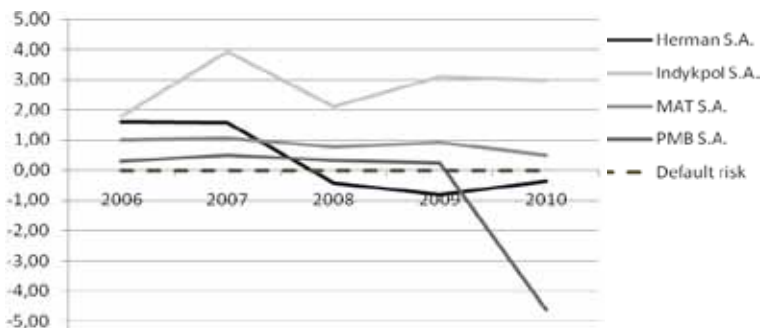
Figure 1. Values of discriminant function of Mączyńska and Zawadzki (Model A) for research companies in 2006-2010
Rysunek 1. Wartości funkcji dyskryminacyjnej Mączyńskiej i Zawadzkiego (Modelu A) dla badanych przedsiębiorstw w latach 2006-2010
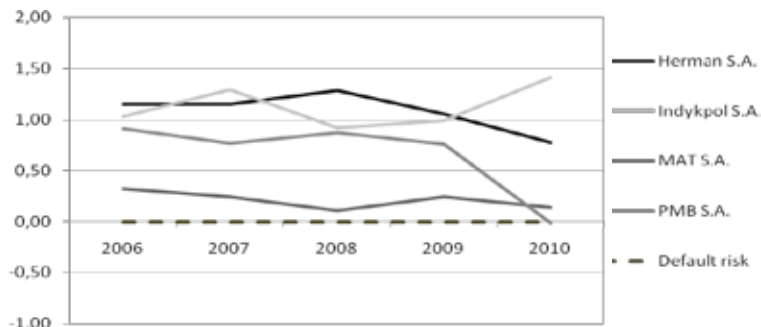Source: own elaboration based on financial statements data from Info Veriti database *Financial statements*... 2006-2010
Źródło: opracowanie własne na podstawie sprawozdań finansowych pochodzących z Bazy Info Veriti Financial statements... 2006-2010

Figure 2. Values of discriminant function of Mączyńska and Zawadzki (Model G) for research companies in 2006-2010
Rysunek 2. Wartości funkcji dyskryminacyjnej Mączyńskiej i Zawadzkiego (Modelu G) dla badanych przedsiębiorstw w latach 2006-2010
Source: see fig. 1
Źródło: jak na rys. 1

Figure 3. Values of discriminant function of Hołda model for research companies in 2006-2010.
Rysunek 3. Wartości funkcji dyskryminacyjnej Hołdy dla badanych przedsiębiorstw w latach 2006-2010
Source: see fig. 1
Źródło: jak na rys. 1

Conclusions and recommendations

There exist various reasons and factors causing bankruptcy and not all of them can be observed while analyzing historical financial data, much less if the one year prior to bankruptcy data is not available. Models used in the paper give various results thus using more than one model for assessing the bankruptcy risk and comparison of the effects in order to state the most probable future results is essential for the company's management.

High risk of bankruptcy does not always have to mean a future default. Herman S.A. is a good example of company which despite facing significant financial problems and high default risk for few years, did not go bankrupt but implemented a thorough restructuring (assuming also change of business activity) in 2012.

When it comes to the tested hypothesis, the results are incoherent. Model elaborated for production sector, Hołda model, was used in the thesis as a comparison to general models used in Poland. It resulted that significantly different outcomes were observed while applying this model. While both Mączyńska and Zawadzki models classified Herman S.A. as a company threatened with default since 2008, Hołda model indicated no risk until 2010. The hypothesis can be considered as partially true since Herman S.A. did not go bankrupt despite financial problems faced.

Methods and models available for the polish companies do not guarantee accurate predictions and assessment of the bankruptcy risk in every case (MAT S.A. case). Elaboration of the models considering only food industry or even meat industry as operating in characteristic conditions and dependent on different factors than other sectors would be recommendable.

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Streszczenie

Głównym celem badań było przedstawienie i opis metod stosowanych do analizy ryzyka finansowego, zarówno na rynku polskim, jak i ogólnoświatowym. Analiza została przeprowadzona na przykładzie czterech polskich firm z sektora mięsnego, z których dwie ogłosiły upadłość w 2012 r. (Polski Przemysł Mięsny i Drobiarski MAT S.A., PMB S.A.), a pozostałe dwie nadal funkcjonują (Indykpol S.A., Zakłady Mięsne Herman S.A.). Analiza i ocena ryzyka opierały się na danych zawartych w sprawozdaniach finansowych z lat 2006-2010 dostępnych w bazie Info Veriti, dostawcy informacji gospodarczej w Polsce. Oszacowano poziom ryzyka upadłości towarzyszący każdej z firm w badanym okresie. Określenie ryzyka bankructwa przeprowadzono z wykorzystaniem modeli analizy dyskryminacyjnej opracowanych dla rynku polskiego, tj. modeli Mączyńskiej i Zawadzkiego, a także modelu Hołdy opracowanego dla firm produkcyjnych. Ukazano zalety i ograniczenia zastosowanych metod.

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