QUANTITATIVE METHODS IN ECONOMICS
Vol. XIV, No. 1, 2013, pp. 190 – 201

THE USE OF ACCRUAL-BASED AND CASH-BASED APPROACH IN EVALUATING THE OPERATIONAL FINANCIAL THREAT OF ENTERPRISES FROM THE TSL SECTOR - EXAMPLE OF APPLICATION OF THE DISCRIMINANT ANALYSIS

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Abstract: In the reference books one can find information about a lot of models for forecasting financial threat for Polish enterprises. These models vary as they use different measures of evaluation. However, there are very few cases in which measures using data from a cash flow statement are used. The main goal of the paper is to create a model for evaluating of operational financial threat of enterprise from TSL sector using both accrual and cash measures. The accomplishment of this objective is justified by a need for empirical research on mixed models of the evaluation of operational financial threat of enterprises i.e. based on both accrual and cash measures.

Keywords: operational financial threat of enterprise, financial position of enterprise, discriminant analysis, transport, forwarding and logistic sector

INTRODUCTION

Logistics activity that mostly deals with time-spatial transformation of all kinds of goods, capital and accompanying information determines a series of changing conditions for efficient and effective continuation of business activities. In view of a specific character of conducted logistics activity, its subject and the range of services on TSL market this activity may encounter various obstacles, distortions and threats.

Operational financial threat includes real and potential symptoms of a destructive influence of financial factors on enterprise's capability to achieve and maintain a financial condition conducive to a continuation of its activity.

Early recognition of operational financial threat should be then one of the basic tasks of an economic entity's management and also an essential determinant for initiating corrective actions in advance.

The major objective of the paper is to create a model for evaluation of operational financial threat of enterprises from TSL sector using both accrual and cash measures. It is commonly known that there are neither generalized discriminant models nor financial measures acting as universal predictors of financial threat for enterprises of all types and sizes [Malinowska et al. 2005][1].

The accomplishment of this objective is justified by a need for empirical research on mixed models of the evaluation of operational financial threat of enterprises i.e. based on both accrual and cash measures.

The main research hypothesis formulated in order to achieve the objective of the paper took the form of the following statement: the discriminant models for the TSL sector enterprises that use cash measures show a predictive ability that is comparable or higher than in case of models taking into consideration only accrual measures.

ECONOMIC SUBJECTS AND METHODOLOGICAL GROUNDS OF EMPIRICAL RESEARCH

In view of the fact that putting an enterprise into bankruptcy is regulated by specific legal acts[2] and financial threat is a liquid and dynamic category that is placed between the best situation (i.e. „sound" enterprise) and a terminal one (i.e. bankruptcy of an economic entity) [Gruszczyński 2012] in order to set a research sample the author used data about TSL sector enterprises which were

[1] The research carried out by L. Karbownik indicated that in case of TSL sector enterprises the predictive ability of models for forecasting financial threat which are presented in the reference books was significantly lower in relation to its initial level. i.e. assumed by the researchers of the subject [Karbownik 2013].

Predictive ability i.e. accuracy of enterprise classification to group of bankrupt companies or those not at risk of bankruptcy which is evaluated among others on the basis of very often used method, which is called confusion matrix.

The higher classification accuracy of enterprise to one from the two groups i.e. group of bankrupt companies or those not at risk of bankruptcy, the higher predictive ability of discriminant models.

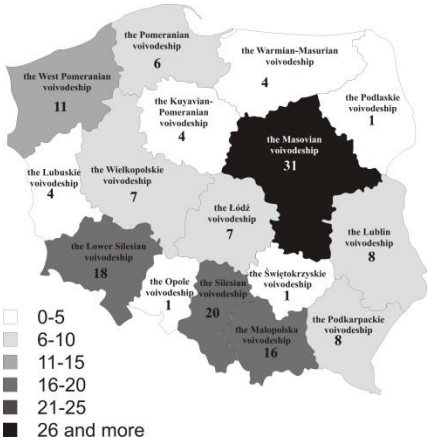
[2] According to Article 10 of the Act of 28 February 2003 on the Law on Bankruptcy and Reorganization (Journal of Laws from 2003 no 60, p. 535 as amended) debtor's bankruptcy is declared when he is proved insolvent.

Article 11 of this act stipulates that debtor is considered insolvent if he does not settle financial liabilities, whereas debtor acting as a legal entity or an organizational unit without legal entity but for which the other act guarantees a legal capacity, is considered insolvent when value of their liabilities exceed the value of its assets, even if liabilities are settled up to date.

declared bankrupt by the court. The majority of models of financial threat are currently based on this kind of data as it is easier to obtain.

According to the data from the Economic Information Centre in Warsaw in the period between 2004-2010 the biggest number of bankruptcies from „Transport and warehouse management" section was noted in the Masovian voivodeship (31 companies - see Figure 1).

Figure 1. Number of enterprises declared bankrupt from „Transport and warehouse management" section in Poland between 2004-2010 by voivodeships



Source: own study on the basis of data from the Economic Information Centre Ltd.

The subsequent selection of the research sample was reduced only to the enterprises that:

- were officially declared bankrupt by the court in the period between 2004-2010 (i.e. in company documents there is a ruling declaring bankruptcy),
- submitted individual financial statements (including cash flow statement) to the National Court Register in Warsaw one year or two and three years before declaring bankruptcy [Platt et al. 2002; Prusak 2005][3],
- as a balance sheet date accepted 31 December in each year of the whole analyzed period[4].

The number of bankrupt enterprises participating in the study was reduced (from the initial number of 31 enterprises from TSL sector that submitted financial statements to the National Court Register in Warsaw to only 5 enterprises). It was related to the fact that 20 bankrupt enterprises did not submit cash flow statement

[3] According to H. D. Platt and M. B. Platt enterprise financial failure can occur within 3 years before the moment of declaring bankruptcy, although in many cases failure happens in the period shorter than 3 years from the moment of declaring bankruptcy.

[4] Lack of financial data prevented conducting a discriminant analysis for a bigger research sample in this period.

in the whole analyzed period and in case of 6 enterprises such statements were not available for at least one of the analysed years.

Discriminant analysis requires taking into consideration two groups of economic entities and that is why it was conducted for 5 enterprises one year, two and three years before declaring their bankruptcy[5] as well as for 5 companies with no risk of bankruptcy [Pogodzińska et al. 1995][6]. The author made an attempt to find for bankrupt companies some economic entities that met specific criteria, namely:

- conducted business activity in the same sector (i.e. TSL sector),
- submitted statements to the same National Court Register (i.e. NCR in Warsaw),
- owned a comparable total size of assets in the analysed year[7].

Therefore, a target research sample[8] comprised 10 entities for each analysed period.

Financial aspect has a specific function in the evaluation of operational financial threat of enterprise as it binds all aspects of its activity that result from making different decisions. In the operational dimension connected with current activity – financial decisions are made in economic units to a very basic extent i.e. they mainly concern financial liquidity, shaping streams of revenues and expenditures or achievement of the best results [Skowronek–Mielczarek 2007; Maślanka 2008].

Taking into consideration high usefulness of cash flow statement for various groups of stakeholders that are interested in survival of a given economic unit it must be stated that it should become an integral part of the evaluation of operational financial threat of enterprise [Duraj 2010; Rutkowski 2000] in order to reflect current economic events suitably.

The evaluation should not be made in isolation, but in mutual relations with other parts of financial statement. Thereby, full dimension of this evaluation will be achieved when data on cash flows are analysed together with other information included in enterprise balance sheet and its profit and loss account.

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[5] Bankruptcy was declared because debtor did not settle due payments and their value exceeded the value of debtor's assets.

[6] M. Pogodzińska and S. Sojak as the first in Poland created – by means of a technique of linear multivariate discriminant analysis a model for only 10 observations.

The model was a good example of using multivariate analysis in empirical research conducted by them, however, it had a very limited practical value for economic practice.

[7] The second part of the sample included carefully selected enterprises in good financial condition, i.e. those which were still functioning (at least after one year since the moment of using data for evaluating parameters of discriminant function).

Financial measures for enterprises not in danger of bankruptcy were calculated respectively for years in which data was collected for bankrupt entities assigned to them.

[8] So-called analytical sample.

Due to the lack of detailed financial data of analysed enterprises from TSL sector the analysis of enterprise operational financial threat was at the initial stage limited to the following 13 diagnostic variables (see Table 1).

Subsequent selection of measures of operational financial threat concerned evaluation of average values of analysed variables, their coefficients of variation and the evaluation of prognostic ability of diagnostic variables, the analysis of correlations between them and evaluation of normality of their distribution. It is of crucial importance as the next phase of the analysis should only include the measures which [Hadasik 1998; Prusak 2005; Maślanka 2008]:

- vary significantly in two groups (i.e. both in bankrupt companies and in those not facing the risk of bankruptcy) – to achieve this intra-group and intergroup coefficients of variation were set down [Maślanka 2008][9];
- are lowly correlated with each other,
- are characterized by a normal distribution [Hadasik 1998; Lipiec-Zajchowska 2003][10].

In order to conduct a discriminant analysis Statistica 10 program was applied, using a stepwise progressive analysis [Stanisz 2007] because in the reference books one can find information that Fisher's linear discriminant function is resistant to lack of normality of distribution [Seber 1984].

NET OPERATING CASH FLOWS IN FORECASTING OPERATIONAL FINANCIAL THREAT OF TSL SECTOR ENTERPRISES

The models of the evaluation of operational financial threat of TSL sector enterprises that are presented in this part of the article were prepared on the basis of financial data from the period comprising one year, two and three years before bankruptcy. To calculate the values of analysed measures data from a balance sheet, profit and loss account and cash flow statement were used. They comprise the activity of 10 analyzed enterprises[11] (analytical sample).

[9] A desirable situation is when values of intra-group coefficients of variation are at the lowest possible level, whereas intergroup coefficients of variation at the highest possible level.

[10] This assumption is crucial from a statistical point of view, however, in the reference books the authors claim that the occurrence of normal distribution is extremely rare, which in fact does not influence on predictive abilities of discriminant functions.

[11] The balanced model stipulates that both groups of companies i.e. bankrupt and with no risk of bankruptcy are of similar sizes (i.e. 5 in each).

Table 1. Selected financial measures of the evaluation of operational financial threat of enterprise*

No	Main areas of the evaluation of operational financial threat of enterprise	Measure		Accrual/cash approach	Symbol
1	2	3		4	5
1	Sales of products (services), goods and materials[12]	net revenues from sales of services, goods and materials	S_t	accrual	m_1
2	Financial liquidity	current ratio	$\frac{CA_t}{CL_t}$	accrual	m_2
3		quick ratio	$\frac{CA_t - In_t - SDE_t}{CL_t}$	accrual	m_3
4		cash ratio	$\frac{C_t}{CL_t}$	accrual	m_4
5		current liabilities coverage ratio with cash from operational activity	$\frac{OCF_t}{CL_t}$	cash	m_5
6	Operating profitability	operating return on sales ratio	$\frac{PoS_t}{S_t}$	accrual	m_6
7		operating return on total assets ratio	$\frac{PoS_t}{\frac{(TA_t + TA_{t-1})}{2}}$	accrual	m_7
8		operating return on equity ratio	$\frac{PoS_t}{\frac{(E_t + E_{t-1})}{2}}$	accrual	m_8
9		cash return on sales ratio	$\frac{OCF_t}{S_t}$	cash	m_9

[12] Analysed companies prepared a cash flow statement by indirect method, so cash measure (OCR – cash revenue from operational activity) is the data that is not included in a financial statement submitted to the National Court Register in Warsaw.

1	2	3		4	5
10	Operating profitability	cash return on assets ratio	$\frac{OCF_t}{\frac{(TA_t + TA_{t-1})}{2}}$	cash	m_{10}
11		cash return on equity ratio	$\frac{OCF_t}{\frac{(E_t + E_{t-1})}{2}}$	cash	m_{11}
12	Short-term financial reserves[13]	hedge ratio no 1	$\frac{SRrb_t}{TA_t}$	accrual	m_{12}
13		hedge ratio no 2	$\frac{OtSR_t}{TA_t}$	accrual	m_{13}

* where:

S_t – net revenues from sales (products (services), goods and materials) at the end of the period,

CA_t – current assets at the end of the period,

In_t – inventory at the end of the period,

SDE_t – short-term deferred expenditure at the end of the period,

C_t – cash and monetary assets at the end of the period,

CL_t – current liabilities at the end of the period,

OCF_t – cash flows from operational activity in period,

PoS_t – profit/loss on sales at the end of the period,

TA_t – total assets at the end of the period,

TA_{t-1} – total assets at the beginning of the period,

E_t – equity at the end of the period ,

E_{t-1} – equity at the beginning of the period,

$SRrb_t$ – short-term reserves for pension benefits and alike at the end of the period ,

$OtSR_t$ – other short-term reserves at the end of the period.

Source: own study on the basis of: [Gmytrasiewicz et al. 1996]; [Sierpińska , Jachna 2004]; [Duraj 2008].

[13] In case of short-term reserves for liabilities only two hedge ratios were accepted as measures of operational financial threat and in their numerator they have either short-term reserves for pension benefits or alike or other short-term reserves.

It turned out that short-term accrued expenses can be included in point B. I. 2 and B. I. 3 as well as in point B. IV. 2. of the balance sheet (here together with deferred revenue). However, the companies did not reveal any detailed information on RMK in additional information and explanations.

On the other hand, cash approach to changes of reserves in a cash flow statement includes change of reserves to total liabilities (i.e. long and short-term), whereas a change of accruals include a total balance of deferred expenditure and accrued expenses.

The results of empirical research presented in the reference books [Largay et al. 1980; Rujoub et al. 1995; Maślanka 2008; Wędzki 2008] provide numerous arguments to justify the need of using measures based on cash flows in order to predict the risk of enterprise bankruptcy. The need is also confirmed by the results of the analysis conducted for the needs of this paper and which involved analyzing values of intra-group and intergroup coefficients of variation of analysed diagnostic variables[14].

Only from the period 3 years before bankruptcy the author eliminated a current liabilities coverage ratio with cash from operational activity (m_5) from the basic measures for distinguishing bankrupt entities from those not facing bankruptcy. It was related to the fact that this measure showed more than 50% total classification error of analysed economic entities from TSL sector.

Two and three years before bankruptcy cash measure was not included in the estimated model for the evaluation of operational financial threat. So, two and three years before bankruptcy it was impossible to verify a research hypothesis formulated in this study. Therefore, in the subsequent part of the paper only discriminant models for one year before bankruptcy of enterprises from the TSL sector will be presented.

In case of one year before bankruptcy - as a result of a subsequent selection - the further discussion took into consideration only 7 measures[15]. This situation was related to a significant correlation between analysed variables, and thus the analysis was restricted only to analyzing those between which a value of correlation coefficient was below 0,8 (at the significance level of 0.05)

Finally, the following measures were qualified for a discriminant analysis: m_1, m_2, m_4, m_5, m_6, m_{12} and m_{13}. By means of the Shapiro–Wilk test it was checked if they are characterized by a normal distribution. As it was supposed in relation to such a small research sample, most of these variable did not have a normal distribution. So one of the most important assumptions from a statistical point of view as far as a discriminant analysis is concerned, was not met. It must be noted, however, that in economic research a normal distribution is really rare. In fact, in practice it does not have any impact on deterioration of prognostic abilities of a discriminant function [Maślanka 2008].

[14] The analyses did not include m_8 and m_{11} because in some analysed enterprises the value of equity capital was negative

The critical value of intergroup coefficient of variation was set at the level v=0,2. All analysed variables met a criterion of sufficient distinction and none of them were eliminated at this stage of empirical research.

[15] Among these measures only m_5 used information from a cash flow statement.

The obtained results (see Table 2) showed that a conducted discriminant analysis was significant (Wilks' lambda = 0,24322, p < 0,0284 [Stanisz 2007][16]). The most useful variable in this analysis at p < 0,05 was only cash ratio. However, at the tendency level (i.e. p < 0,1) also current liabilities coverage ratio with cash from operational activity (m_5) was considered most useful.

Table 2. Summary of function of discriminant analysis (1 year before bankruptcy)

N=10	Variables in model: 3 Grouping: bankruptcy (2 groups) Wilks' lambda: ,24322 approx. F (3,6)=6,2229 p< ,0284					
	Wilks' lambda	Wilks' partial	F-to-remove (1,7)	p	Toler.	1-Toler. (R-Sqr.)
m_4	0,814454	0,298633	14,09153	0,009467	0,575793	0,424207
m_5	0,424579	0,572857	4,47382	0,078811	0,571008	0,428992
m_{12}	0,305514	0,796112	1,53663	0,261403	0,879630	0,120370

Source: own study by means of STATISTICA software

The estimated Model 1 took the following form[17]:

$$Model_1 = - 2{,}3276 + 29{,}3662\, m_4 + 3{,}0424\, m_5 - 48{,}3415\, m_{12}$$

Classification matrix that contained information about the number and proportion of enterprises properly classified in each group proved that all bankrupt enterprises were qualified properly for a specific type of economic entities. There was only one wrongly classified enterprise and it was one of those not in at risk of bankruptcy.

In the subsequent phase of research only 6 accrual measures i.e.: m_1, m_2, m_4, m_6, m_{12} and m_{13} were taken into account. While estimating a model the current liabilities coverage ratio with cash from operational activity (m_5) was excluded. The results of conducted analyses are presented in Table 3.

[16] Wilks' lambda is a standard statistic used to determine statistical significance of discriminant power by currently chosen discriminant variables. Its value falls between 0 (a perfect discriminant power) to 1 (no discriminant power).

[17] Threshold value (threshold point) is 0.

In order to obtain function values on the basis of which classification of objects (enterprises) is made for a specific group – to estimate a model raw data was used i.e. not transformed in any way [see: Prusak 2005].

Table 3. Summary of function of discriminant analysis II (1 year before bankruptcy)

N=10	Variables in model: 2 Grouping: Bankruptcy (2 groups) Wilks' lambda: ,37476 approx. F (2,7)=5,8394 p< ,0322					
	Wilks' lambda	Wilks' partial	F-to-remove. (1,7)	p	Toler.	1-Toler. (R-Sqr.)
m_4	0,629852	0,594994	4,764825	0,065365	0,999988	0,000012
m_2	0,479323	0,781849	1,953139	0,204946	0,999988	0,000012

Source: own study by means of STATISTICA software

Obtained results showed that a conducted discriminant analysis was significant at $p < 0,0322$, and a measure that proved to be most useful here, although only at the level of tendency, was a cash ratio. The model that was estimated was model 1a and it took the following form[18]:

$$Model_{1a} = 2,7243 - 18,6295\ m_4 - 1,4773\ m_2$$

Classification matrix showed that all companies not facing a risk of bankruptcy were classified properly for a specific type of economic entities. This group also included one wrongly classified bankrupt entity.

Presented models 1 and 1a (a canonical discriminant function) were also used to predict the bankruptcy of TSL sector companies from a validation sample (e.g. data in the period between 2011-2012 of four enterprise from the TSL sector). In all variants 75% classification accuracy[19] was achieved.

CONCLUSIONS

The major objective of the paper is to create a model for evaluation of operational financial threat of enterprises from TSL sector using both accrual and cash measures.

As a result of applying a discriminant analysis very simple to interpret models of the evaluation of operational financial threat were estimated. Only in the

[18] Threshold value (threshold point) is 0.

[19] Bankrupt companies from TSL sector that were qualified for a validation sample were declared bankrupt by the court between 2011-2012, submitted individual financial statement (including cash flow statement) to the National Court Register in Warsaw one year, two and three years before declaring bankruptcy and as a balance sheet date accepted 31 December in each year of the whole analyzed period.

One of 4 companies from a validation sample was wrongly classified.

Classification errors, regardless of a type of model, concerned the same enterprise from a validation sample (i.e. DSV Solution Ltd.) It may suggest that the reason for bankruptcy was not related to its financial condition [compare: Mączyńska 2004].

first analyzed period (i.e. one year before bankruptcy) a cash measure of operational financial threat of enterprise (i.e. m_5 variable) was included in the estimated model.

Presented models 1 and 1a (a canonical discriminant function) were also used to predict the bankruptcy of TSL sector companies from a validation sample. In all variants 75% classification accuracy was achieved.

The results of conducted empirical research show that one year before bankruptcy of TSL sector enterprises discriminant models using cash measures show a predictive ability comparable with models estimated only on the basis of accrual measures.

Two and three years before bankruptcy cash measure was not included in the estimated model for the evaluation of operational financial threat. So, two and three years before bankruptcy it was impossible to verify a research hypothesis formulated in this study.

The research involves a selected number of TSL sector enterprises, so in view of its 'sectoral' range they do not predispose to formulate general conclusions. Yet, they are to draw attention to the necessity of creating of discriminant models which are dedicated to various enterprises running service activities.

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