Determining Accuracy of IN05 Index and its Improvement

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Abstract: *The IN05 index is probably the only one model in the world that predicts economic value added (EVA). Determining a positive or negative EVA is conducted based the level of return on equity (ROE). The threshold of the level depends on the changing value of implicit cost of equity (r_e). The Czech economy has undergone many changes including the economic crisis during the ten years following the creation of the IN05 index. This research uses financial data of 1,224 companies in the manufacturing sector. A very low current prediction power of IN05 was detected in prediction of prosperity. The main benefit of the research is finding a way to increase accuracy of economic value added prediction.*

Keywords: *IN05 index, prosperity, economic value added, ROE*

JEL codes: *G24, G33*

Introduction

Bankruptcy models are becoming more popular especially since 2008 when the whole world was hit by the global financial crisis. These models are designed to help analyze not only one's own company but they also allow business partners to recognize the financial situation of companies of interest.

However, the most important attribute of these models is the accuracy of their ability to predict bankruptcy or financial stability of a company in the future, i.e. ex ante in a few years, as stated by Castagnolo and Ferro (2014), Seppa (2014). A typical company, that is most keen to know the financial situation of its partner companies, is a bank. But for the company it is also very useful and instructive to compare with the companies operating in the same sector.

The models are very popular especially because they can be applied easily and provide unambiguously worded outcomes. The difference between the user attitudes to specific methods of determining the financial health of the company is very clearly handled by Mr. and Mrs. Neumaier (2008). They maintain that prosperity and bankruptcy models are more popular compared e. g. to pyramidal systems of indicators (alternative aggregate indicator). That's because they are considerably simpler and basic knowledge is sufficient for processing e. g. in Excel software. To interpret the results is also easier for users.

Probably the most famous models are the models of Altman called „Z-scores". His first bankruptcy model was made in 1968, described in Altman (1968). This model was designed for manufacturing companies in the USA and predicted bankruptcy for a period of up to three years in advance. One year ahead was the highest accuracy of prediction of bankruptcy amounting to 95%, two years by 72%, three-year forecasts with an accuracy of only 48%. For creation of Z score, Altman used discriminant analysis. Training set included 33 bankruptcy companies and 33 financial healthy companies. Following modification called Z´score ("Zed one score") was applicable also for companies not traded at stock exchange, as stated by Altman (2002). It was in 1983.

In the eighties indexes emerged for companies operating in Germany, Austria and Switzerland. One of these indexes was the Creditworthiness index. The Creditworthiness index classifies companies for creditworthy and bankruptcy. In these countries and also in the Czech Republic, the Creditworthiness index is well known and used. As Choi (2003) notes, even despite that it was validated only on test set of 21 companies.

Another worldwide famous model called the Taffler index was created in the UK by Taffler (1982). It was published in 1977 and constructed through the use of linear discriminant analysis. To create the model, 46 bankrupting and 46 prosperous companies were investigated, specifically through financial statements in years 1969 to 1975. The author of the model determines the accuracy of the model as follows:

- correct identification of the bankruptcy with probability of 97% one year before bankruptcy
- prediction of a bankruptcy with 70% probability two years ago
- with probability of 61% three years ago

The Neumaiers' created IN indexes. All of them constructed with data set of companies operating manufacturing industry in the Czech Republic. Overall they created four indexes. They called them IN95 index (in order to prevent bankruptcy), IN99 index (for prosperity prediction), IN01 and IN05 index are both used for bankruptcy and also prosperity prediction. The IN05 (2005) index is a modification of the IN01 index (2001). IN05 index is based on the analysis of 1526. Authors declare a success rate at 88% for economic value added prediction and probability of 77% for bankruptcy as stated by Neumaierová and Neumaier (2005).

Kuběnka and Slavíček (2014) state that models of prosperity as well as bankruptcy models were usually created differently, the structure of most of them is similar, as the combination of ratios and assigned weights of importance. However, IN indices for prosperity prediction (IN99 & IN05) were made on a sample of real companies, therefore they are exceptional.

In 2013 Delina and Packová (2013) published a model for bankruptcy prediction called the P 'model. This model does not use classical statistical methods, but the methods for selecting the data used in data mining. The model was based on analysis of sample including 1560 Slovak companies of which 103 went bankrupt. Authors declare accuracy 78.24%.

Karas a Režňáková (2014) created a new bankruptcy model in 2014. This model is based also on linear discriminant analysis with a data set of 1,508 companies operating in the manufacturing industry in the Czech Republic. There were 880 financially stable companies and 628 companies in bankrupt. The authors declare overall accuracy from 87.81% to 91.7% (on the base of weighted accuracy). The ability to determine creditworthiness reaches from 97.89% to 91.47% for the model.

However the ability to predict bankruptcy is significantly lower from 69.91% to 61.18%.

The newest knowledge confirms that the time as well as branches are key for some specific ratios, as the newest research by Karas and Režňáková (2015) performed with the sample of 34533 companies from manufacturing and construction branch states "*we found that only 8 of 17 analysed predictors were significant in all of the analysed five year prior bankruptcy, 8 of them in the branch of manufacturing (i.e. EBITDA/TA, S/TA, S/St., EBIT/Int., EBITDA/Int., FA/TA, S/OR and S/CL.), the same set (with exception of S/TA) is also significant in the construction branch. As same predictors are time specific, or even not significant at all, this lead us to conclusion, that only some predictors could be used as early warning indicators or used to predict bankruptcy more years ahead.*"

Where:

EBITDA/TA - EBITDA/total assets,
S/TA – Sales/total assets,
S/St. – Sales/stock,
EBIT/Int. - EBIT/interest,
EBITDA/Int. - EBITDA/Interest,
FA/TA - EBITDA/total assets,
S/OR - Sales/operating revenue,
S/CL - Sales/current liabilities.

The presented accuracy is often debatable, mainly due to the fact, that:

- authors created the model for a small sample and thus the presented accuracy is not statistically based,
- authors presented the total accuracy based on the average of achieved accuracy in the sphere of bankruptcy prediction as well as prosperity prediction,
- authors confuse the accuracy and the rate of return,
- when comparing the accuracy of models the researchers do not regard the fact that the prosperity IN99 and IN05 (or IN01) is derived from EVA.
- authors take into account or make average of achieved accuracy in the sphere of bankruptcy or prosperity prediction,
- results of authors are not comparable, as they work with various ratios of bankrupting and financially sound companies.

In addition, for example Růčková (2011) points out the area limitation of prediction models and states that ratios of ensemble work with researches of specific economic conditions that are not identical. Kuběnka (2015) and Vochozka (2011) point out the different definition of the term "failure" or "bankruptcy" and the issue of definition of the bankruptcy moment that is related to the legislation of specific country.

The evaluation of predictive capability of bankruptcy models is usualy performed based on the comparison of current situation with the situation one year before. Thus the prosperity or bankruptcy predicted by the model (in the year X) versus the current situation of the following year (X + 1).

Then the accuracy of bankruptcy model prediction is (in relation to the table 1) defined in various ways:

1) as the conditioned probability $\pi_j = TP_j / (TP_j + FP_j)$, applied by Neumaierová and Neumaier (2005), Altman (2006),
2) as the probability (rate of return) $p_j = TP_j / (TP_j + FN_j)$ applied by Delina and Pacáková (2013),
3) as the weighted average $p_j n_j = (TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j)$ applied by Karas and Režňáková (2014),
4) as the weighted average with subjectively defined weights for the purpose of creation of models chart, based on their accuracy, applied by Sušický (2011) or Maňasová 2008,
5) as the arithmetic average $p_j n_j = ((TP_j / (TP_j + FN_j)) + (TN_j / (TN_j + FN_j)))/2$ applied by Neumaierová and Neumaier (2005)

Table 1 Contingency Table of Possible Results

	$\theta(d_i, c_j)$ = true	$\theta(d_i, c_j)$ = false
$\hat{\theta}(d_i, c_j)$ = true	TP_j	FP_j
$\hat{\theta}(d_i, c_j)$ = false	TN_j	FN_j

Note: $\hat{\theta}$ means estimate, θ means fact
Source: Lee (2009)

Where:

TP_j – number of companies that went bankrupt and their bankruptcy was predicted by the model
FP_j – number of companies that went bankrupt, but their financial health was predicted
TN_j – number of companies that went not bankrupt and their financial health was also predicted
FN_j – number of financially sound companies for which the bankruptcy was predicted

Table 2 Verification of Accuracy of Prosperity and Prosperity-bankruptcy Models

	Model	Incorrect bankruptcy prediction	Accuracy of bankruptcy prediction p_j	Rate of return of the bankruptcy prediction π_j	Year
a)	Index of prosperity	78.02%	21.98%	58.25%	97-07 SK
b)	IN05	85.41%	14.59%	73.79%	97-07 SK
c)	IN01	x	60%	x	04-08 CZ
d)	IN05	x	70%	x	04-08 CZ
e)	IN05		62%		04-08 CZ
	Model	**Incorrect prosperity prediction**	**EVA prediction accuracy p_j**	**Rate of return of EVA prediction π_j**	**Year**
f)	IN99	x	85%* / 47%**	x	98/04 CZ
g)	IN01	x	77%	x	2000 CZ
h)	IN05	x	83%	x	2004 CZ

a), b) source Delina and Pacáková (2013); c) to e) Sušický (2011) unclear methodology of measurement; f) to h) Neumaierová and Neumaier (2002); Neumaierová and Neumaier (2005); * at the index compilation; ** at the verification in the year 2005

The prosperity model accuracy is not shown in measurement of prosperity, except for one exception. Results of several researches are shown in the table 2. The following validation was focused on measurement of the capability to predict the bankruptcy using the prosperity model (Index of prosperity) and to predict the prosperity using the model (IN99) and the prosperity – bankruptcy model (IN01 and IN05). Kuběnka (2015) emphasizes that IN99, IN01 and IN05 are specified by the fact that only those for which there is a presumption of economic value added creation are classified into the category of creditworthy companies, and thus the only presumption of positive return of equity is not sufficient for the positive rate of return of shareholders' capital.

The authors of IN05 states it "was created and tested on data from mainly medium and large industrial firms, so for these firms it will have the best explanatory power." That is why the current prediction capability of this model will be tested on middle-sized companies. According to Neumaierová and Neumaier (2010) the index has following form:

$$IN05 = 0.13\,X_1 + 0.04\,X_2 + 3.97\,X_3 + 0.21\,X_4 + 0.09\,X_5 \tag{1}$$

Where:

X1 = total assets / liabilities
X2 = earnings before interest and taxes / interest paid
X3 = earnings before interest and taxes / total assets
X4 = revenues / total assets
X5 = current assets / current liabilities$01 = 0{,}13X_1 + 0{,}04X_2 + 3{,}92X_3 + 0{,}21X_4 + 0{,}09X_5$

When IN05 is greater than 1.60 the firm produces a positive EVA value with a probability of 83%. When IN05 is smaller than 0.90, the firm gets in financial distress ("bankruptcy zone") within a year with a probability of 77% (for middle-sized companies 78%). Firms with the value between these two extremes fall into a "gray zone" and they cannot be clearly determined.

The goal of this research is determining accuracy of IN05 Index in prediction of prosperity and Its Improvement.

1 Data and Methodology

1.1 Data and Calculation of IN05 Index

The sample for testing the prosperity prediction using the model IN05 was compound of 1224 companies from the Czech Republic, from the manufacturing industry, with turnover above 300 million that showed no negative symptoms (failure, execution, insolvency, extinction, negative shareholders´ capital) in the year 2012. This sample was compared with the prosperity level of analyzed companies in 2013. It means that the investigated period was one year. Data were drawn from the database of economic entities MagnusWeb of the company Bisnode.

The financial data from the balance sheet and profit and loss statement of chosen companies were applied in the formula (1).

Input values were defined as follows:

- *earnings before interest and taxes* (EBIT) is the sum of lines „*" no. 30 + „*" no. 48 + „XIII." no. 53 – „R." no. 54.
- *revenues* are the sum of all revenue categories I. up to XIII., i.e. no. 1 + no. 4 + no. 19 + no. 26 + no. 28 + no. 31 + no. 33 + no. 37 + no. 39 + no. 42 + no. 44 + no. 46 + no. 53,
- *current liabilities* including short-term liabilities and short-term loans, i.e. line „B.III." no. 103 + „B.IV.2." no. 117 + „B.IV.3" no. 118.

Resulting values of intermediate calculations were adapted as follows:

- within the calculation of interest coverage, i.e. components X2 the problems of zero division were found in about one quarter of cases. Resulting values X2 were limited at -9 in case of the negative EBIT value and +9 in case of positive EBIT values.
- there were also extremes with resulting values X2 directed towards +/- ∞ due to low values of cost interests approaching the zero. These extremes were reduced up to the interval <-9; +9>. Such reduction was performed in about one third of cases.

1.2 Procedure of Calculation of Economic Value Added EVA

If the model IN05 in the year X (in this research the year 2012) achieves for a specific company a value higher than 1.6, the company should reach the positive EVA value in the following year X+1 (in this research the year 2013).

The abbreviation EVA refers to the so-called economic value added. Officially, the historical beginning of this indicator is considered the year of 1982. At that time Joel Stern founded the Stern Stewart & Co. and began to use it for the performance measurement of companies. As the unofficial beginning of this indicator can be considered earlier in period of 90s of the 19th century when Alfred Marshall mentioned economic and accounting profit as the first as stated by Kyriazis and Anastassis (2007).

We rank the EVA indicator among the so called value indicators. Another well-known example is the indicator of marked value added (MVA). The task of the EVA is to express the value of economic profit. Economic profit includes cost of equity, it means we must take opportunity costs into account.

Economic value added represents part of company profit generated over the expectations of investors. This money can be employed to invest in company development as stressed by Tortella and Brusco (2003), Kangarloei et al. (2012).

There are several options how to calculate the value of EVA. Let's introduce the main ones. E.g. Vochozka and Stehel (2013) express it in this way:

$$EVA = EBIT(1-t)-C \times WACC \quad (2)$$

Where:

EVA Economic Value Added

EBIT Earnings before Interests and Taxes
t Income Tax Rate
C Capital provided for Remuneration
WACC Weighted Average Cost of Capital.

Another way of EVA calculation is using the indicator NOPAT (Net Operating Profit After Taxes). Then the formula looks as follows according to Tortella and Brusco (2003):

$$EVA = NOPAT - (D+Ebv)\times WACC\ WACC \tag{3}$$

Where:

EVA Economic Value Added
NOPAT Net Operating Profit After Taxes
D Debt Book Value
Ebv Equity Book Value
WACC Weighted Average Cost of Capital.

There are numerous types of EVA calculations. In order to verify the prediction capability of IN05 the EVA calculation, as applied by authors of the model, IN05 will be used.

$$r_e = \frac{\frac{WACC*UZ}{A} - \frac{(1-d)*U}{BU+O} * \left(\frac{UZ}{A} - \frac{VK}{A}\right)}{\frac{VK}{A}} \tag{4}$$

Where:

re – implicit costs of shareholders´ capital
UZ -are paid sources (bank loads, obligations, shareholders´ capital),
WACC - weighted average of costs on capital,
A - are assets,
D - tax rate,
U - cost interests,
BU + O - bank loans and obligations,
VK - shareholders´ capital.

For the calculation by rating methodology, it is necessary first to define the value of WACC using the modular methodology. According to Neumaierová and Neumaier (2002) this method is applied under the following simplifying presumptions:

- The current or estimated interest rate is the value of loan capital.
- The market value of loan capital equals to the account value.
- Resulting value of WACC index is independent from the level of shareholders´ or load capital, in case of the indebtedness change, the total capital costs are only re-distributed among owners and creditors.
- Operational economical results equals to the EBIT value, i.e. to the sum of gross profit and cost interests.

$$WACC = rate\ of\ the\ risk\text{-}free\ assets + r_{company} + r_{finstab} + r_{LA} \tag{5}$$

Where:

$r_{company}$ - extra charge for the volume of business risk,
r_{finstr} - extra charge for the risk resulting from capital structure,
$r_{finstab}$ - extra charge for the risk that the company is not able to pay back its liabilities,
r_{LA}- is the risk extra charge for the size of company.

EVA shall be defined based on the positive spread value (ROE – re), which is according to Lízalová (2010) and Máče (2005) sufficient conditions if we are based on the relation used also by the Ministry of industry and trade for creation of statistics for particular branches:

$$EVA = (ROE - re) * E \quad (6)$$

Where:

ROE - return of equity
E – equity
(ROE – re) - spread

2 Results and Discussion

Results of the application stated in table 4 show different accuracy with comparison of values given by the authors in the year 2005. The accuracy of IN05, based on data from the year 2004, was 83% for the sphere of prosperity prediction for middle-sized companies. The updated value of accuracy based on data from the year 2012/2013 corresponds to the column f.) tab. 4, i.e. to the accuracy of 89.37%. The reliability interval π can be, according to Pacáková (2003), determined as follows.

$$P\left(p - z_{1-\frac{\alpha}{2}}\right) * \sqrt{\frac{p(1-p)}{n}} < \pi < \left(p + z_{1-\frac{\alpha}{2}}\right) * \sqrt{\frac{p(1-p)}{n}} = 1 - \alpha \quad (7)$$

Where:

p - the original accuracy of IN05 amounting to 83%,
n - the size of the base π, i.e. $TP_j + FP_j$, i.e. 254,
α - determined at the level of 5%,

The resulting reliability interval for the original accuracy of 83% is within <78.38; 87.62> percent. Thus it can be stated that the resulting accuracy of IN05 within the prosperity measurement, based on the methodology f.) tab. 4, has increased by 6.37% after the period of 9 years (important notice: on sample of companies with no negative symptoms – it means failure, execution, insolvency, extinction, negative shareholders´ capital) in the year 2012.

In the opinion of the author the most objective accuracy measurement, for the sphere of prosperity, is the calculation based on the approach stated in column h.) tab. 4. This one takes into account the whole correct predictions and compares it with the whole tested ensemble of companies, including those that are within the grey zone. Based on this index the capability of model IN05 to predict the positive EVA achieves 49,26%. If we do not take into account the uncertainty area (grey zone), the prediction capability grows up to 75.38%.

Table 4 Result of Application IN05 at the Original Grey Zone <0.90;1.60>

Column: a.	**b.**	**c.**	**d.**	**e.**	**f.**	**g.**	**h.**
$IN05_{2012}$ vs. EVA_{2013}		Results of application	Relative expression	Rate of return p_j = TP_j / (TP_j + FN_j)	Conditioned probability π_j = TP_j / (TP_j + FP_j)	Weighted average p_jn_j = (TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j)	Weighted average p_jn_j = (TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j + GZ)
Good prediction + EVA	TP_j	227	18.55	57.18%	89.37%	75.38%	49.26%
Defect prediction + EVA	FP_j	27	2.21				
Good prediction - EVA	TN_j	376	30.72				
Defect prediction - EVA	FN_j	170	13.89				
Grey zone	GZ	424	34.64				
Suma		1224	100%				

Source: Author

In order to increase the accuracy, the tests were performed when original evaluation scale limits <0.90;1.60> were shifted. According to the methodology g.) tab. 5 the accuracy was growing with lowered upper limit. The highest accuracy of 75.50% was achieved when the upper limit was lowered at the value 1.4. At the same time the model was not able to include 26.63% of companies into the category +EVA or **–**EVA and incorrectly included 44.61% of companies from the tested sample of 1224 companies.

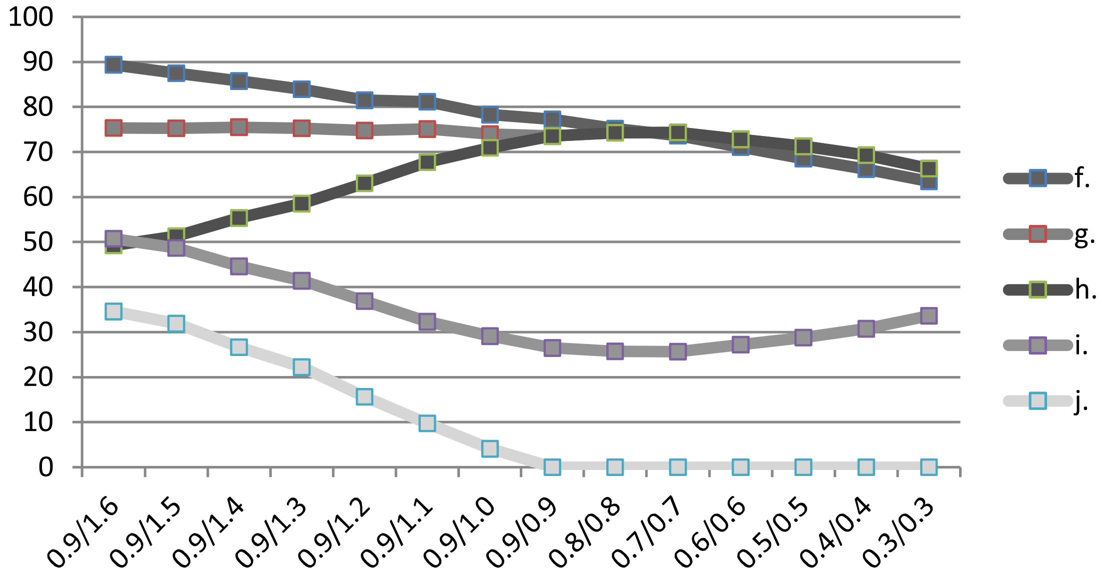
Table 5 Results of IN05 Application with Moved Limits, without Grey Zone

Upper limit	**1.6**	**1.5**	**1.4**	**1.3**	**1.2**	**1.1**	**1.0**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**
Lower limit	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.8**	**0.7**	**0.6**	**0.5**
Good prediction + EVA	227	252	302	341	396	453	492	524	565	592	608	632
Defect prediction + EVA	27	36	50	65	90	105	136	154	186	212	247	290
Good prediction - EVA	376	376	376	376	376	376	376	376	344	318	283	240
Defect prediction - EVA	170	170	170	170	170	170	170	170	129	102	86	62
e. p_j = TP_j / (TP_j + FN_j)	57.18	59.72	63.98	66.73	69.96	72.71	74.32	75.50	81.41	85.30	87.61	**91.07**
f. π_j = TP_j / (TP_j + FP_j)	**89.37**	87.50	85.80	83.99	81.48	81.18	78.34	77.29	75.23	73.63	71.11	68.55
g. GOOD 1: pjnj= (TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j)	75.38	75.30	**75.50**	75.32	74.81	75.09	73.94	73.53	74.26	74.35	72.79	71.24
h. GOOD 2: pjnj = (TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j + GZ)	49.26	51.31	55.39	58.58	63.07	67.73	70.92	73.53	74.26	**74.35**	72.79	71.24
i. WRONG: (FP_j + FN_j) / (TP_j + FP_j + TN_j + FN_j + GZ)	50.74	48.69	44.61	41.42	36.93	32.27	29.08	26.47	25.74	25.65	27.21	28.76
j. Grey zone	34.64	31.86	26.63	22.22	15.69	9.80	4.08	0.00	0.00	0.00	0.00	0.00

Source: Author

Relation between threshold (limit) and model accuracy is seen also in graphical form below. There is evident that to increase the accuracy we need to raise the grey zone. E.g. accuracy 89.37% (type f. with limits 0.9/1.6)) is not the maximum achievable value. This accuracy can be even more increased. But with limits 0.9/1.6 there is 34.64% unclassified companies (so called "grey zone"). With higher accuracy is connected also higher grey zone as seen on the graph. Author does not recognize the maximization of accuracy through the existence of the grey zone.

Figure 1 Relation between Threshold(s) and Accuracy



Note: f. $\eta_j = TP_j / (TP_j + FP_j)$, g. $p_j n_j$ 1= $(TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j)$, h. $p_j n_j$ 2= $(TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j + GZ)$, i. WRONG: $(FP_j + FN_j) / (TP_j + FP_j + TN_j + FN_j + GZ)$, j. Grey zone

Source: Author

The methodology can not be used to find the maximum accuracy. This is because it ignores good prediction of negative EVA (failed prediction of negative EVA). The methodology g seems to be appropriate because it reflects the ability to predict both positive and negative economic value added. However, the result can be misleading due to the fact that a large portion of the analyzed sample is not classified (companies included in grey zone). As the most suitable methodology seems methodology h. The methodology works with the whole sample and the total accuracy includes the whole sample, both classified and unclassified companies.

Then, in the author´s opinion, it is the most suitable to move limits at the value 0.7 and to eliminate the grey zone at the same time. The model accuracy, in predicting the prosperity according to the methodology h.), achieves the maximum accuracy amounting to 74.35% with zero grey zone and 25.65% of error rate from the complete tested sample.

Conclusions

It is not easy to assess the financial stability of business partners or debtors and/or to conduct it on the basis of publicly available data in a speedy, simple and precise manner. It is obvious that these diagnostic/predictive models always operate with some degree of inaccuracy. The question is, what can the maximum achievable value of accuracy be?

Finite precision is affected by many factors. Especially in the phase of model creation these factors are size and homogeneity of the training set, data quality, methodology for data processing and technique of model creation. Following this phase of accuracy testing the key factors are size and homogeneity of the validation set, data quality (accounting provides a fair view), process for treating of data, as well as the methodology chosen for the measurement of total model accuracy.

The aim of this research was to define the accuracy of the IN05 model after the period of 9 years from its creation. This prosperity-bankruptcy model was, as one of the few, created based on real data using the multiple discrimination analysis. The accuracy was derived from the capability of the model to predict the economic value added in the following year. This enables to verify its up-to-date condition. The results of calculations of the tested sample showed, with statistical significance, that the accuracy of prosperity prediction has increased from 83 to 89.37%, when the accuracy is calculated based on TP_j / (TP_j + FP_j). At the same time, 50.74% of companies (from the whole sample 1224) were classified incorrectly.

The testing of the threshold of <0.90;1.6> shift up to the unified critical limit at 0.7 resulted in the best result of the prediction capability of this model, based on (TP_j + TN_j) / (TP_j + FP_j + TN_j + FN_j + GZ). The achieved accuracy of 74.35% is the ratio of all correctly classified companies related to the size of the whole sample (1224). The conditioned probability of the correct classification +EVA (based on TP_j / (TP_j + FP_j) is 73.63%. In order to reach a quick classification of the company, using the IN05 idex, aiming to define its prosperity, the author recommends using the newly defined limit of 0.7.

In addition, the research conducted confirmed that the declared accuracy of models can be considerably different depending on the methodology of accuracy quantification (tab. 4 columns from e.) to h.)). In conclusion, it shall be pointed out that the research conducted confirmed that the accuracy of models can change with time, especially if their accuracy evaluation is based on spread value connected with variable r_e value. For example, the mean of r_e and ROE changed as follows in these years: r_e 10.58% in 2007, 11.14% in 2008, 15.36% in 2009, 13.52% in 2010, 13.66% in 2011, 8.40% in 2012, 7.42% in 2013, ROE 15.11% in 2007, 10.85% in 2008, 6.45% in 2009, 11.61% in 2010, 11.52% in 2011, 21.88% in 2012, 20.33% in 2013.

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