Possibilities of financial health indicators used for prediction of future development of agricultural enterprises

Možnosti využití ukazatelů finančního zdraví k předpovědi budoucího vývoje zemědělských podniků

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Abstract: The paper presents the possibilities how financial health indicators can be used both for the prediction of future value of agricultural holdings and for the prediction of the potential risk and dangers. The limited predicative ability of all indicators as compared to th recommended values is revealed in the first part of the paper. The second part of the article proves the hypothesis of the efficiency of indices in the inter-enterprise and time comparison. According to this hypothesis, holdings with a higher index value should be more successful in the following years. This part of investigation has shown the conditional efficiency of the Gurčík index and the IN99 index for the prediction of the increase in the value of a company. The relation between the calculated value of an index and the value of its future profit/loss has been proved for those indices. The possibilities how to predict a bankruptcy are limited. Agricultural holdings are threatened both with a long-term negative profitability and with a sudden fluctuation in the profit/loss from operations together with a high debt ratio. Each type of danger largely applies to a different kind of holding and each type of danger is indicated by a different kind of index. The possible problems with the long-term negative profitability have been indicated reliably by the OP index of financial health and by the Gurčík index. Problems with solvency have been partially predicted by the IN95 index and the Chrastinová index (these results were not statistically significant). The final part of the paper is aimed at the analysis of the advantages and disadvantaged of individual indices. A number of financial indicators for agricultural holdings correlate with the future development of a holding but the relation is non-linear (e.g. debt ratio indicators) or outweighed by another factor (e.g. activity indicators, where the development corresponds rather to the production specialization). Another reason for unsatisfactory results of the prediction are the frequent extreme values of the non-standardized indicators. The predicative ability of individual indicators is also reduced by the unsuitable setting of weights for indicators.

Key words: bankruptcy, financial analysis, financial health, shareholder's capital value, prediction of future development, variability, agricultural holding

Abstrakt: V článku jsou prezentovány možnosti využití ukazatelů finančního zdraví, a to jak k predikci vývoje budoucí hodnoty zemědělských podniků, tak predikce případných rizik a ohrožení. Z první části článku vyplývá omezená vypovídací schopnost většiny ukazatelů při porovnání s doporučovanou hodnotou. Druhá část článku ověřuje hypotézu o využitelnosti indexů v mezipodnikovém a časovém srovnání, podle které by měly být podniky s vyšší hodnotou indexu v dalších letech úspěšnější. Tato část šetření ukázala podmíněnou využitelnost Gurčíkova indexu a indexu IN99 pro predikci růstu hodnoty firmy. U těchto indexů byla prokázána závislost mezi vypočtenou výší indexu a hodnotou budoucích hospodářských výsledků. Možnosti predikce bankrotu jsou omezené. Zemědělské podniky jsou ohroženy jednak dlouhotrvající zápornou rentabilitou, jednak náhlými výkyvy provozního hospodářského výsledku při vysoké zadluženosti. Oba typy ohrožení se do značné míry týkají jiného typu podniků a na každé z těchto ohrožení reaguje jiný typ predikčního ukazatele. Na možné problémy s dlouhodobou zápornou rentabilitou dobře upozorňovaly indexy finančního zdraví OP a Gurčíkův index. Problémy se solventností částečně předpovídaly indexy IN95 a index Chrastinové (statisticky významně neprokázáno). Závěrečná část příspěvku se zaměřuje na analýzu silných a slabých stránek jednotlivých indexů. Řada finančních ukazatelů

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zemědělských podniků sice vykazuje korelaci s budoucím vývojem firmy, ale závislost je nelineární (například ukazatele zadluženosti), nebo je převážená jiným faktorem (např. ukazatele aktivity, kde vývoj odpovídá spíše výrobnímu zaměření). Dalším z důvodů neuspokojujících výsledků predikce jsou časté extrémní hodnoty nestandardizovaných ukazatelů. Vypovídací schopnost jednotlivých indexů snižuje i nevhodné stanovení vah pro jednotlivé ukazatele. Příspěvek je součástí řešení výzkumného záměru MSM 6007665806.

Klíčová slova: bankroty, finanční analýza, finanční zdraví, hodnota vlastního kapitálu, predikce budoucího vývoje, variabilita, zemědělský podnik

Methods for the prediction of the future development of a holding (no matter whether of bankruptcy or an increase of the value of a holding prediction) can be divided into one-dimensional or multidimensional. One-dimensional methods are based on finding several individually assessed indicators so that each of them would allow classifying holdings as successful or unsuccessful, such as the Beaver's profile analysis. On the contrary, the value of multidimensional indicators consists of several summarized indicators. The advantage of multidimensional methods is a clear classification of a holding as successful or unsuccessful (the results with one-dimensional method may be inconsistent). Some multidimensional methods allow not only predicting the solvency problems and the possibility of bankruptcy but also assessing othe possible growth in the value of a holding. The following are treated as the owner indices: the Tafler index; the Neumaiers IN97 and IN01 indices (this index is treated as combined); and the Gurčík index that is designed for agricultural holdings. On the other hand, the Altman index; the Neumaiers IN99 index and CH index are treated as bankruptcy indices.

There is a number of methods for predicting of the financial shortcoming and their results may be useful both for the owners of holdings, their partners and the possible creditors.

Recently, the importance of these methods has increased as the application for the Operational Programs subsidies is under the condition of an evaluation of financial health report within the feasibility study.

In many cases, the predictive ability of these indices does not match with their distribution and it is limited, especially for such specific branch as agricultural production.

For that reason, it would be useful to find out such indices that could be used to predict the growth of an agricultural holding's value.

The first aim of this paper was to assess the efficiency of indices predicting the future development of a holding and finding out such indices that could be used to assess agricultural holdings.

To fulfil this task, we had to set the following partial tasks:

– To identify the individual categories of holdings. For the bankruptcy identifiers, it was necessary to classify the holdings as endangered holdings or holdings without problems. For value indices, it was necessary to classify the holdings as profitable or unprofitable.
– To analyse an ability of an index to classify (by a comparison with a recommended value) a holding as successful or unsuccessful (bankruptcy or non-bankruptcy).
– To set the relation between the value of an index and the future development of a holding. This part followed the unsatisfactory results of the previous article. The aim of the investigation was to verify the hypothesis that holdings with higher values of the predictive index will be more successful and profitable and that they will have a higher value for their owners and a lower possibility of bankruptcy or danger in the following years.
– To identify the advantages and disadvantages of indices with the aim to assess such parts of an index (indicators of financial analysis) that influence the possibility of prediction in the positive way and such parts that decrease the predictive ability.

MATERIAL AND METHODS

The analysed database and assessed indicators

The selected sample was set out from agricultural holdings with the double-entry accounting in 1996 to 2006. The Faculty of Economics has a database of 890 holdings. The selected sample consists of 117 holdings assessed at least in six consecutive years. The index was calculated for the first assessed year, the following years worked for verifying the success of the index.

We used the following prediction indices: the Altman model and Z-score, the Neumaieris indices, the Tafler model, and the Value index (Blaha, Jindřichovská 2006; Dluhošová 2006; Synek 2007). We also assessed the indices designed specifically for agricultural holdings.

Gurčík evaluated the specific features of agricultural holdings in Slovakia with his index (Gurčík 2002). The Gurčík index is treated as an owner index. It means that it allows classifying agricultural holdings with primary production as profitable and unprofitable. The CH-index of Chrastinová is also of Slovak origin (Gurčík 2002). Last but not least, we assessed the results of the index of financial health according to the operational program [(Rosochatecká, Řezbová 2004) and (MZE 2007)]. In our paper, we classified a holding with an overall number of points over 15 as a holding without problems and a holding with more than 20 points as successful.

Delimitation and identification of profitable holdings

The way of separating the successful and sufficiently profitable holding from the unsuccessful ones differs among the authors of the indices of prediction. Gurčík would classify a holding as successful if it reached more than 8% of the ROE for three consecutive years (Gurčík 2002). Froněk designed a model for evaluation of holdings and their rating (an average score) consisting of the following partial indicators: net income (profit/loss), value added, operational assets and investment (Froněk et al. 2007). Neumaierová classify successful holdings in the exact way (Neumaierová, Neumaier 2002). According to her, a successful holding reaches a positive value of the EVA indicator. The specification of capital costs for a large database of holdings is a problem of this approach.

The cumulated profit/loss (the sum of all profits) for five years under investigation was chosen as a criterion of success. Due to the different size of holdings, its value was related to the volume of assets in the year zero (i.e. in the year when the index was calculated). The resulted value gives the amount of profit produced in the period of five years by the original 1 CZK of assets. Table 1 shows the structure of the database.

A relatively long five-year period was chosen as the profit/loss variability of agricultural holdings is high. In addition, this high variability is influenced primarily by external factors (such as the influence of exercise prices). The absolute level of profitability of a holding in thea particular year is not primarily influenced by the way of its management. It is influenced by the "success" of the whole year. Using the sum of profit/loss within five years reduces the influence of variability to a great extent.

The high variability of profit/loss also results in the fact that the success of holdings was measured by their rank in the database (with the Spearman correlation coefficient). When the influence of external factors is too dominant, then the absolute success of holdings (measured by the value of profitability) is not an appropriate measure of reliability of the indicator of the prediction. The way of financial management does not influence the absolute success of the holding. It only influences its relative success (measured by the order of the holding in the set.

Three types of the cumulated profitability value were set out gradually as a limit of positive profitability (Table 1). The least strict assessment calculated with a zero profitability as the limit. This profitability does not result in the nominal (accounting) decrease of the value of a holding. The second limit was set at the level of 10%. This limitation counts with the inflation within the last five years and with the average structure of assets. 10% level of profitability should provide at least keeping the real value of the assets. The strictest limit had set the 25% level of the cumulated profitability. This value stands for about 5% of profitability per year and it should provide the owners with at least the minimum revenue.

Table 1. Structure of the database of the assessed holdings according to a five-year profitability

Cumulated profitability in 5 years	Number of holdings (absolute)	Number of holdings (relative %)
Holdings with profitability above 25%	8	6.84
Holdings with profitability from 10.01 to 25%	29	24.79
Holdings with profitability from 0.00 to 10%	41	35.04
Holdings with profitability from –10% to –0.01%	25	21.37
Holdings with profitability from –25% to –10.01%	11	9.40
Holdings with profitability below –25%	3	2.56
Total	117	100.00

Source: Own investigation

Delimitation and identification of problem holdings

At first, we investigated the holdings within out database that really went bankrupt. In the database of 890 holdings, we were able to find 112 holdings that went bankrupt or had to wind up without any succession organization in the period under our investigation (1996–2006). Unfortunately, we were able to keep a complete three-year time line only for 36 holdings from the above mentioned group and to get complete data from all years preceding the termination of holding's activity. The investigation of this group has shown that agricultural holdings are threatened both by the long-term negative profitability that does not enable a sufficient reproduction of long-term assets, and by a sudden steep fluctuation in the operation profit/loss together with a high debt ratio. The causes of bankruptcy within the operation area were typical for the holdings situated in higher altitudes. Especially the holdings from the areas with the altitude over 450 m had to wind-up due to the debt ratio. The difference between the LFA and non-LFA holdings is affirmed by other researches (Střeleček et al. 2007; Sojková et al. 2008). Large differences in the way of production between the holdings from mountain and sub-mountain regions make the creation of a universal agricultural index of prediction more difficult to a great extent. Table 2 shows the course of bankruptcy.

The delimitation of problem holdings resulted from these dangers. The analyzed database of 117 holdings has provided both entities with loss in the whole period under investigation (the sum of profit/loss for five years under investigation was negative) and the entities with the profitability in the five year period but with the negative cash flow from operations (EBIT + depreciation + creation of reserves + creation of adjustments + change of net operation capital) so that they were in the danger of bankruptcy due to the acute insolvency.

Evaluation of index efficiency

When evaluating the possibilities of prediction of the endangered holdings, such index of financial health will be considered to be successful if it is able to indicate the possible problems in the future (danger due to the low profitability or due to the low cash flow from operations). The percentage of correctly classified holdings was a decisive factor for evaluation. The following situations might occur: successful holding correctly classified as successful; successful holding classified into the grey zone; successful holding misclassified as endangered; problem holding classified into the grey zone; correct classification of problem holdings.

Evaluation of the index ability to predict the future development of a company

The ability to predict future problems following the negative profitability has been analysed with the correlation and regression analysis method. We investigate the relation of the future profit/loss (cumulated profit/loss in five-year period) to the value of the index (calculated for the year zero). As explained above, the relation of the level of the index to the future relative success of a holding (with the Spearman coefficient) measured by the order in the database has been investigated at the same time.

The ability to predict the danger following the fluctuation of cash flow has been analysed by the comparison of a group of holdings without problems and a group of endangered holdings. In doing so, we tested the zero hypothesis that they reached level of the bankruptcy index is not statistically significantly higher for the holdings without problems in comparison with the endangered holdings (compared to the alternate hypothesis that the index value is higher for the holdings without problems). Testing of the differences was realized by the comparison of

Table 2. Development of the elected financial indicators for holdings with and without bankruptcy

	1 year before winding up				2 years before winding up				3 years before winding up			
	ROA (%)	EBIT/assets (%)	Debt/assets (%)	Current ratio	ROA (%)	EBIT/assets (%)	Debt/assets (%)	Current ratio	ROA (%)	EBIT/assets (%)	Debt/assets (%)	Current ratio
Holdings with altitude to 450 m above the sea level	–3.1	1.5	60.7	3.16	–0.8	5.3	57.4	3.10	0.9	4.8	61.5	3.11
Holdings with altitude from 600 m above the sea level	–2.8	–0.6	43.6	3.72	–3.3	–1.3	46.8	3.78	–3.5	–0.7	46.2	3.99

Source: Own investigation of 36 holdings (28 from production areas; 8 from marginal areas)

mean values based on the Student's t-distribution on the significance level of $p = 0.025$. A specific way of testing was chosen after performing the analysis of homogeneity of variance with the Fisher-Snedecor test.

Analysis of advantages and disadvantages of an index

In order to assess the advantages and disadvantages of an index, we investigated the influence of its components on the overall classification of a holding. We investigated the partial correlation coefficients and average values of financial indicators (i.e. the individual components of an index) as well as their variability (via standard deviation). The reached level of an indicator and its variability was recalculated for the corresponding number of points and rated to the number of points necessary for classifying a holding as successful. The aim of the investigation was to identify if there is a component of an index causing the usual misclassification. The indicators that allowed a holding to obtain too many points compared to the required level of an index (for example some indices attached to some agricultural holdings several fold of the number of points necessary to their classification among the successful only for the current ratio), indices with a too high variability (for example the difference in the number of points obtained within the standard deviation of interest coverage indicator has a crucial influence on the classification of holdings with the IN indices) could be seen as problematic.

At the same time, we calculated the average values of the individual components of an index and for the individual categories of holdings. The aim was to identify such index components that allow observing a statistically significant difference among categories. The statistically significant difference in the level of indicator between the successful and problem holdings identifies an index component that allows a successful prediction. Index components, that usually cause misclassification, can be identified analogically from the differences between the successfully and incorrectly classified holdings.

RESULTS AND DISCUSSION

Delimitation and identification of problem holdings

Table 3 shows the values of the basic financial and operation indicators calculated for the year zero, i.e. for the first year under investigation. The holdings are classified into four categories according to their future development: holdings without problems; holdings in danger due to the long-term negative profitability; problems in danger due to the cash-flow fluctuation; and holdings in danger due to both factors. At the same time, statistical significance of the difference between these groups is identified. The start of the investigation revealed that holdings with the negative profitability and those with the combined types of danger are only one group, actually. The character-

Table 3. Characteristics of holdings in danger

		Number of holdings	Average altitude	Rate of revenue from animal production (%)	Profitability of assets (%)	Rate of profit (%)	Turnover rate	Turnover rate for short-term assets	Debt ratio (%)	Current ratio
Holdings without problems		66	485	44	0.87	1.41	0.68	1.98	53.8	4.93
Danger only due to cash flow		14	423	32	6.01	6.00	0.99	2.54	62.8	5.39
Danger only due to profitability		14	548	63	0.73	1.1	0.61	2.04	52.7	4.65
Parallel types of danger		23	563	67	–0.9	–3.3	0.62	1.56	62.2	5.3
Statistically significant difference between holdings without problems	and holdings in danger due to cash flow	YES	YES	YES	YES	YES	YES	YES	NE
	and holdings in danger due to profitability	NO	YES	YES	NO	NO	YES	NO	NO

Source: Own investigation

istics of holdings with the combined danger equals to the holdings with low profitability, only the extent of the danger and loss is more significant. These two groups consist of holdings that usually farm in the areas in a higher altitude and can be characterized by a loss from the operation area that is long-term and permanent. The turnover rate is lower than the turnover rate of an average holding, especially for the turnover rate of short-term assets. The a rate of revenues from plant production is lower than the average. On the other hand, the debt ratio indicators seem to be more favourable, the rate of debts to assets is lower (we can assume a limited availability of bank credits) and the following lower loss from financial activities. The common current ratio is higher than the average (the influence of the production specialisation). However, the differences in the value of the acid test are not significant.

The differences between holdings without problems and endangered holdings have been identified as statistically significant for the following features: rate of revenues from plant production; profitability of assets; rate of profit and turnover rate for short-term assets. Using these indicators in prediction indices would increase their reliability for the prediction of dangers connected with negative profitability.

Holdings in danger due to insolvency are characterized by a lower altitude, a higher rate of revenues from plant production, a higher profitability, a higher turnover rate and higher debt ratio. Using the indicators with the statistically significant difference between the endangered holdings and the holdings without problems would increase the ability of indices and their ability to predict danger due to the fluctuation of solvency.

The influence of current ratio is interesting. This indicator is of the negative correlation to the profitability of assets; on the other hand, a high common current ratio of agricultural holdings from the lower areas allows a flexible reaction to profitability fluctuation by selling a part of supplies. When holdings in danger due to insolvency were identified only according to the internal cash flow (EBIT + depreciation + creation of reserves + creation of adjustments), the influence of the current ratio was negative (due to the negative influence on profitability). The positive influence of the high common current ratio was revealed only when the holdings in danger were identified according to the cash flow from operations (EBIT + depreciation + creation of reserves + creation of adjustments + change of net operation capital). Holdings with a higher rate of short-term assets could react to the decline of profitability and sell a part of their supplies in order to avoid the negative cash flow. This positive influence was evident only partially (this result was not statistically significant) for the

Table 4. Efficiency of indices (%)

Category of holdings		Successful holdings (total 66)			In danger due to profitability (total 37)			In danger due to cash flow (total 14)		
	System of classification	correctly classified	classified as the grey zone	misclassified as unsuccessful	correctly classified	classified as the grey zone	misclassified as unsuccessful	correctly classified	classified as the grey zone	misclassified as unsuccessful
Value and combined indices	IN 99	0.00	13.64	86.36	81.08	13.51	5.41	0.00	21.43	78.57
	IN 01	16.67	63.64	19.70	64.86	24.32	10.81	7.14	28.57	64.29
	Tafler index	22.73	57.58	19.70	5.41	64.86	29.73	7.14	78.57	14.29
	Gurčík index	4.55	65.15	30.30	70.27	27.03	2.70	0.00	21.43	78.57
	Index of financial health	71.21	28.79	0.00	21.62	70.27	8.11	35.71	57.14	7.14
Bankruptcy indices	Altman index (68)	39.39	45.45	15.15	18.92	54.05	27.03	14.29	21.43	64.29
	Altman index (83)	36.36	50.00	13.64	29.73	45.95	24.32	7.14	28.57	64.29
	Altman index (95)	33.33	46.97	19.70	24.32	56.76	18.92	0.00	21.43	78.57
	IN 95	19.70	43.94	36.36	43.24	40.54	16.22	7.14	35.71	57.14
	Value index	22.73	46.97	30.30	32.43	43.24	24.32	0.00	7.14	92.86
	CH-index	15.15	63.64	21.21	24.32	72.97	2.70	0.00	57.14	42.86

Source: Own investigation

holdings in lower altitude and only for the common current ratio. The holdings from higher situated areas are of a high current ratio due to the production specialisation (a high rate of actually illiquid animals for fattening) and this current ratio does not protect them against the problems with solvency.

Assessment of index efficiency in comparison with the recommended value

Table 4 shows that the only index with practical usage (without any adjustment) is the index of financial health according to the operational program. This index was more successful in the prediction profitability problems – 71% of successful holdings were classified correctly, the remaining 29% was classified into the grey zone. 64% of unprofitable holdings were classified as the grey zone. This results from the financial standing feature of this index. The efficiency of this index was lower for the prediction of danger due to solvency (about 35% of correctly classified + 57% in the grey zone). The success of this index is caused (in addition to its specialization in agricultural holdings) especially by a large number of components that allows to involve a number of possible problems and the system of awarding points for the individual features that eliminates the possibility of influence of the extreme values of a single indicator. The possibility of a detailed classification of holdings into a number of categories is another advantage.

The rest of indices can be divided into bankruptcy and owner indices. As can be seen from the table, there is virtually no predicative ability of the value of the indicator itself (in comparison with the recommended value). For owner indices, an agricultural holding usually does not reach the value necessary to classify a holding as successful. In fact, it usually corresponds with the situation in agriculture, but it classifies also exceptionally successful holdings with long-term profitability as unsuccessful. A similar situation is valid for bankruptcy models that classify the majority of holdings as the grey zone and they are not able to identify the insolvent holdings at the same time.

Assessment of the ability of indices to predict the future development of a holding

Table 5 shows the assessment of the predictive ability of financial health indices in terms of the prediction of profitability development. It shows the relation between the value of an index (calculated for the year zero, i.e. the first year under investigation) and the volume of profit/loss for five consecutive years. Proving statistical dependence would allow using these indices at least for comparison. A higher index value would predict the future increase in the profitability of a holding. The correlation coefficient and the Spearman coefficient were used for this assessment.

The investigation has proven the efficiency of the IN 99 index and the Gurčík index. These indices classify the most successful holdings to the grey zone in comparison to the absolute value, though, the relation between index value and future profitability is relatively strong (the value of the Spearman coefficient 0.31 and 0.29). The insignificant classification can be explained by the requested profitability level.

Table 5. Correlation between the index value and profitability reached in five consecutive years

Correlation coefficient		Year 1	Year 1–2	Year 1–3	Year 1–4	Year 1–5	Determination coefficient 1–5 (%)	Value of Spearman correlation coefficient	Proving of statistical dependency
Owner's models	IN 99	0.39	0.17	0.27	0.40	0.38	14.44	0.29	YES
	IN 01	0.17	0.10	0.12	0.10	0.14	1.96	0.14	NO
	Tafler index	0.15	0.19	0.14	0.20	0.16	2.53	0.18	YES
	Gurčík index	0.01	0.15	0.21	0.24	0.36	12.96	0.31	YES
Bankruptcy or value indices	Altman index (68)	0.00	0.02	0.04	0.04	0.06	0.36	0.11	NO
	Altman index (83)	–0.02	0.03	0.07	0.06	0.07	0.49	0.08	NO
	Altman index (95)	–0.04	0.00	0.03	0.05	0.06	0.36	0.11	NO
	IN 95	0.10	0.12	0.14	0.1	0.17	2.86	0.10	NO
	Value index	0.11	0.03	0.03	0.23	0.21	3.75	0.14	NO
	CH-index	0.9	0.10	0.17	0.17	0.15	2.20	0.16	NO

Source: Own investigation

For example, Gurčík has designed his index as the value index and only the holdings with shareholder's capital profitability above 8% were considered to be successful. However, only 3 entities from our sample were able to keep this value in the period of all five years. Using activity indicators can also be seen as a disadvantage of the Gurčík index. Within agricultural holdings, these indicators are influenced more by the structure of products than by the production efficiency itself.

The indices have reached significantly worse results in the prediction of financial shortcomings due to the failure of cash flow. The majority of bankruptcy indices suppose a little variability and permanency in the level of profitability and activity indicators. On the other hand, a sudden and steep fluctuation in the profit/loss is typical for agriculture. This variability follows the changes in profitability of production of the individual commodities and it is strongly dependent on external factors (the influence of weather conditions and exercise prices) so that it is almost impossible to predict.

Table 2 and 3 also showed that the holding in danger represented a specific group, with the dominant plant production, a significantly lower profitability (but a high variability) and activity values above average. The bankruptcy models emphasizing the above mentioned factors classified those holdings as very successful (Table 6). The index of financial health, the IN95 index and the CH-index were the only exceptions. The indices emphasize the debt ratio and the current ratio indicators and so they were able to reveal a possible danger. Neither has their predictive ability reached the statistical significance on the rated level of importance. Traditionally, the indicator of financial health according to the operational program has reached the best results. Its success results form a large number of the assessed features and the way of classification that eliminates extreme values. Using this index in agriculture can be seen as useful. However, the best way how to predict the possible danger is to use the partial indicators of the financial and operational analysis only. In particular, a high debt ratio (a low rate of supplies that does not allow for selling supplies in the case of the shortcoming of sales revenues, respectively) and especially a too narrow base of products aimed only at the selected commodities of plant production can predict the possible danger.

The assessment of advantages and disadvantages of the individual identifiers

The Altman model and Z-Score: Neither version of the Altman model supports the specific features of agricultural holdings. The level of an index predicts neither the development of the future value of a holding nor the possible profitability problem. It also cannot be used to predict the solvency problem – actually, the holdings with problems reached better results than those without problems (7.74 points compared to 6.05). The correlation between the value

Table 6. Differences between holdings without problems and endangered holdings

Differences between holdings without problems and endangered holdings		Holdings without problems		Holdings in danger due to profitability		Holdings in danger due to cash flow		Proving of statistical dependency between holdings without problems	
		ϕ	δ	ϕ	δ	ϕ	δ	unprofitable holdings	insolvent holdings
Owner's models	IN 99	0.47	0.25	0.39	0.27	0.68	0.33	NO	NO
	IN 01	1.13	1.23	1.05	0.74	1.63	1.35	NO	NO
	Tafler index	0.1	1.72	0.22	0.31	0.30	0.23	NO	NO
	Gurčík index	–0.02	0.97	–0.4	0.60	0.01	1.04	YES	NO
Bankruptcy or value indices	Altman index (68)	6.05	2.19	5.95	3.31	7.74	6.01	NO	NO
	Altman index (83)	2.18	1.2	2.15	1.53	2.79	2.82	NO	NO
	Altman index (95)	1.72	0.76	1.70	1.15	2.20	2.13	NO	NO
	Value index	0.64	0.92	0.34	0.96	1.67	1.60	NO	NO
	IN95	2.38	2.82	2.16	2.92	3.07	3.942	NO	NO
	CH-index	–2.94	4.08	–3.1	2.33	–3.9	4.49	NO	NO
	Financial health according to OP	23.9	3.53	21.5	3.74	21.4	4.44	YES	NO

Source: Own investigation

Table 7. The influence of indicators to overall level of analysed indices

Index	Feature	Average value of an indicator (%)	Weight of an indicator in an index	Weighted value of an indicator (number of points)	Rate of reached value to requested level of an index (%)	Standard deviation of an indicator (%)	Weighted standard deviation (number of points)	Rate of weighted standard deviation to requested value of an index (%)	Correlation between a value of an indicator and future profitability	Spearman correlation between value of an indicator and reached profitability	Proving of statistical dependency
Altman model	Working capital/assets	24.79	6.56	1.63	25.02	12.62	0.83	12.74	0.92	0.03	NO
	Retained profit from previous year/assets	8.78	3.26	0.29	4.41	18.64	0.61	9.35	–17.1	–0.12	NO
	EBIT/assets	1.58	6.52	0.11	1.63	4.95	0.33	5.12	24.9	0.27	Yes
	Shareholder's/ foreign capital	1.83	1.05	1.92	29.5	2.94	3.09	47.53	1.52	0.15	NO
	Revenues/assets	0.71	3.25	2.29	35.3	0.29	0.95	14.64	31.55	0.35	Yes
IN 01	Assets/foreign capital	2.85	0.136	0.37	19.4	2.95	0.38	51.19	1.41	0.14	NO
	EBIT/interests	3.47	0.04	0.14	18.5	20.2	0.81	107.3	3.17	0.05	NO
	EBIT/assets	1.58	3.71	0.06	9.3	4.95	0.19	25.89	24.9	0.27	Yes
	Revenue/assets	0.71	0.21	0.15	19.7	0.29	0.06	8.20	31.55	0.35	Yes
	Common current ratio	5.0	0.09	0.46	60.5	7.32	0.66	87.87	–36.9	–0.18	NO
IB-index	Cash flow/foreign capital	23.0	1.15	0.27	26.7	26	0.29	29.50	18.6	0.09	NO
	Assets/foreign capital	2.85	0.08	0.23	22.8	2.95	0.24	23.62	1.41	0.14	NO
	Profit/assets	1.24	10	0.12	12.4	5.65	0.57	56.50	22.25	0.25	Yes
	EBIT/revenues	1.09	5	0.05	5.5	8.08	0.40	40.38	22.49	0.28	Yes
	Supplies/revenues	0.38	0.3	0.11	11.34	0.21	0.06	6.45	29.28	0.32	Yes
	Revenues/assets	0.71	0.1	0.07	7.0	0.39	0.03	2.93	31.55	0.35	Yes
Gurčík index	Retained profit from previous year/assets	8.78	3.412	0.3	16.7	18.64	0.64	35.33	–17.1	–0.12	NO
	Profit/assets	1.24	2.226	0.03	1.5	5.65	0.12	6.86	22.25	0.25	Yes
	Profit/revenues	0.97	3.277	0.03	1.7	7.98	0.26	14.52	21.28	0.27	Yes
	Cash flow/assets	9.0	3.149	0.29	16.0	7.0	0.20	11.38	50.2	0.48	Yes
	Supplies/revenues	0.38	–2.063	–0.78	–42.2	0.21	–0.44	–24.6	29.28	0.32	Yes
Tafler index	EBIT/Short-term debts	0.01	0.3	0.003	0.08	2.48	0.74	248	–45.5	–0.27	NO
	Short-term assets/ assets	37.12	0.53	0.2	65.7	11.54	0.06	20.4	–2.23	0.01	NO
	Short-term debts/ assets	12.43	0.1	0.01	4.14	14.21	0.01	4.74	–2.63	0.05	NO
	Sales revenues/ assets	0.71	0.18	0.13	42.3	0.29	0.05	17.56	31.55	0.34	Yes
	NOC/variable costs	0.09	0.16	0.01	4.98	0.12	0.02	6.39	–22.5	0.14	NO

Source: Own investigation

of the Altman index and the level of the future increase of a holding ranges to 6%. The assessment with the Spearman coefficient is unfavourable in a similar way (max. 0.11 with the version from 1968).

The disadvantages of the prediction of the development of profitability result especially from the indicator of the "retained profit from previous year/assets" with thee negative correlation (–0.12 for the Spearman coefficient) and from the indicator of the "working capital/assets" and the "shareholder's capital/foreign capital" with correlation coefficients approximately 0. Note the negative correlation for the retained profit from the previous year/assets. The result of this indicator was unfavourably influenced by a group of holdings with an extremely high undivided loss. Many holdings reported a high loss or even a negative value of the shareholder's capital at the beginning of our investigation. The selected sample (the sample of holdings under investigation for the period of six years) consisted of the group of the most successful ones that were able to improve their profit/loss a lot; the rest of entities went bankrupt during the period of investigation. Holdings in the worst situation at the beginning have finally either reported the highest values of the cumulated profitability and survived (they were included in our investigation, in such case) or an increase in their profit was only the average and this situation has resulted in their bankruptcy (and they were excluded from the investigation).

If the negative correlation for the long-term profitability was caused by the change of the database structure more likely the failure of the other two indicators will be a result of the real way of a management of a holding. The indicators of working capital rather refer to a specialization of agricultural holding's production; on the other hand, the unfavourable influence of the "shareholder's capital/foreign capital" ratio is caused especially by the fact that it is a non-standard indicator. This indicator has caused the incorrect classification of the whole index the most frequently due to the frequent extreme measures. The change of the debt ratio expressed in this way of 1 standard deviation has led to the change of the value of an index of 3.09 points, i.e. almost a half of the value necessary to classify a holding as successful (Table 7). There is a certain relation of the future profit/loss and the profitability and activity indicators. This correlation is stronger for the activity indicators (the Spearman coefficient of 0.35 and 0.27). The disadvantage of activity indicator (in spite of the satisfactory result of correlation) is that the reached values are influenced by the specialization of production, which is for agricultural holdings primarily determined by altitude. As a result, the profit/loss predicted with regression equation does not correspond with the real profit/loss. The prediction is more optimistic than the reality for holdings with a lower altitude. For holdings in the sub-mountain areas, the real results are better than the prediction. A possible solution could be the recalculation of activity indicators with regard to the altitude of the calculation of regression equation separately for each category of altitude. The ability to predict a danger for a holding from the negative profitability corresponds (with minor exceptions) to the results of predictions of the future value of a holding. Holdings in danger due to a low profitability has differed fro the successful holdings in the assets profitability (0.87% for the successful; 0.28% for the unsuccessful), in the revenue profitability and in theactivity indicator for short-term assets (number of turnovers 1.98 in comparison to 1.74). The difference in mean values for the other components of the index was not significantly important.

The inability to predict an increase of the value of a holding could be expected for the Altman index (it is a bankruptcy index). Far worse is the inability to predict the danger and problems with solvency. The Altman index for endangered holdings has been even higher (6.05) than for the holdings without problems (7.74). The causes of such failure are especially the activity far better indicators for the holdings without problems (this follows the production specialization of holdings in the areas with lower altitude). The influence of the debt ratio (significantly better values for the holdings without problems) has not been statistically significant due tothe unsuitable non-standard form of the indicator.

IN indices: The bankruptcy index IN 95 has classified the majority of holdings to the grey zone; approximately one third has been identified as bankruptcy-liable and about 20% has been classified as successful. Therefore, this index is inapplicable in comparison with the recommended values. In spite of its bankruptcy features, we were able to prove the correlation with the future profit/loss at the level of 10% (measured with the Spearman coefficient). Regarding the partial components of this index, it is profitability and activity that are correlated to the future value of profitability. The influence of the debt ratio and the interest coverage is decreased by their high variability. The influence of the current ratio indicator is negative. The IN95 index has proven a certain success in case of predicting problems with solvency, especially some of the partial components of this index. It is possible to positively assess the influence of the partial indicators of the current ratio and the debt ratio (possible usage of this indicator is decreased by its high variability).

The IN01 index is by far less efficient. This indicator suffers from all disadvantages described for the IN95 index and in the case of the prediction of the future value is multiplied by the negative impact of the current ratio – due to a relatively higher value of the indicator.

The value of the index IN99 has classified 86% of holdings as unprofitable with no value for their owners. It is questionable (with regard to the results of the Gurčík index) whether the assessment of this index is not too strict. Profitability of agricultural holdings is actually really extremely low, on the other hand the result of this index is negatively influenced by the turnover rate of assets (the low value of this indicator is consistent with the production specialization of a holding). The investigation has proven a relation of the level of the index with the future profit/loss of a holding (the Spearman coefficient of 0.29). In particular, profitability (the Spearman coefficient of 27%) and the turnover rate (correlation of 35%) indicators play a positive part in the prediction of the future development of a holding. Debt ratio indica-

Table 8. Differences of the partial indicators of the individual indices between successful and problem holdings

Differences between holdings without problems and endangered holdings		Holdings without problems		Holdings in danger due to profitability		Holdings in danger due to cash flow		Proving of statistical dependency between holdings without problems	
		ϕ	δ	ϕ	δ	ϕ	δ	unprofitable holdings	insolvent holdings
Profitability indicators	EBIT/assets	1.68	4.77	0.57	4.38	3.24	5.64	0	0
	EBIT/revenues	1.73	6.04	0.36	10.0	6.13	8.20	0	0
	Net profit/assets	0.87	3.89	–0.28	3.78	6.01	7.2	(+)	(–)
	Net profit/revenues	1.41	4.8	–1.67	10.0	6.0	7.3	0	(–)
	Retained profit from previous year/assets	11.01	18.03	10.01	15.64	–4.12	24.0	0	(–)
	Cash flow/assets	9.40	6.42	6.71	5.23	12.8	5.22	(+)	(–)
Activity indicators	Revenues/assets	0.69	0.24	0.61	0.26	0.99	0.32	0	(–)
	Revenues/fixed assets	1.14	0.65	1.28	1.97	2.05	1.56	0	(–)
	Revenues/short-term assets	1.98	0.73	1.74	0.53	2.5	1.18	(+)	(–)
	Supplies/revenues	3.37	1.79	2.68	0.97	4.35	2.38	(+)	(–)
	Revenues/active debts	6.05	2.94	6.09	2.63	2.26	33.33	0	0
	Revenues/short-term obligations	5.26	4.40	8.51	5.97	10.3	7.1	0	(–)
	Short-term assets/assets	36.0	9.7	36.4	12.6	43.7	14.1	0	(–)
	Supplies/assets	22.2	6.6	24.4	9.3	27.1	11.59	0	0
Debt ratio indicators	Debt/assets	53.83	26.5	58.5	31.3	63.7	36.1	0	(–)
	Shareholder's/ foreign capital	1.60	1.99	1.95	3.09	2.5	5.61	0	0
	Assets/foreign capital	2.61	1.99	2.96	3.09	3.66	5.61	0	0
	EBIT/interests	3.23	22.5	1.51	10.86	10.5	25.9	0	0
	Cash flow/interests	11.25	45.4	11.52	37.3	45.2	92.8	0	0
	Debt/cash flow	7.68	11.17	9.57	21.99	5.12	2.76	0	(+)
Current ratio	Common current ratio	4.93	8.94	5.04	4.10	5.39	3.04	0	0
	Acid test	3.75	8.53	4.18	3.66	3.38	3.13	0	0
	NOC/assets	24.95	12.9	23.32	11.7	26.4	11.28	0	0

Notes: (+) Value of an indicator for holdings without problems is significantly higher than for endangered holdings, (–) Value of an indicator for holdings without problems is significantly lower than for endangered holdings, (0) Statistically non-significant difference of mean values

Source: Own investigation

tors seem to be non-significant. The current ratio influences the prediction of the future profitability in a negative way. The correlation of this indicator to the level of future profits is a negative one (the Spearman coefficient of –18%). The current ratio also negatively influences the prediction of dangers due to the negative profitability. This indicator is absolutely unsuitable for the prediction of such kind. The average current ratio value of agricultural holdings reaches the level of 3–4 points (in particular, due to accounting animals for fattening as supplies) and it goes beyond the limit usual for agricultural holdings approximately two times. Subsequently, this value is sufficient (this indicator's weight in the index is 0.1 points) to provide a favourable index for a bankruptcy holding. Moreover, the situation is complicated by the non-typical development of the current ratio for holding from the areas with a higher altitude. In particular, the common current ratio of the submountain holdings even further increases (Table 2). We think that this non-typical development is caused by the inability of agricultural holdings to rapidly react to any decrease of demand and problem with sales by a decrease of production. This is followed by an increase of the volume of supplies but it does not cause (due to the substantial "material self-sufficiency" of these holdings) a similar increase of the volume of short-term obligations.

The value index: The evaluation of holdings according to the absolute level of the IB value index and the recommended values is also impossible. Approximately a half of holdings are classified as the grey zone, there is about 20% of correctly classified holdings. The overall value of the index is negatively influenced namely by a low number of points for the activity indicators. An average holding has obtained only 0.07 points (for the turnover rate) and 0.11 (for the turnover rate of supplies). The above mentioned values are less than 10% of the value necessary to classify a holding as successful. However, a low turnover rate is typical for agricultural holdings and it cannot be seen as a sign of the forthcoming bankruptcy.

On the other hand, we are able to prove the relation of the value of the index and the level of the future growth of the value of a holding (the Spearman index correlation of 0.14). The majority of th partial components of this index are correlated for the future profit/loss. The Spearman correlation coefficient ranges from 9% (for the indicator of debt maturity) to 35% (for the indicator of a turnover rate of assets). The non-standard indicator of debt ratio (the Spearman coefficient of 0.04) is the only exception. Similar results were reached when assessing the difference of mean values of the successful holdings and the holdings in danger due to profitability.

It is impossible to use the value index in case of the prediction of problems with solvency. It is a paradox that this index itself as well as the majority of its components (indicators of profitability and especially indicators of activity) reaches better results for the endangered holdings than for the successful holdings. The only exception are the indicators of debt ratio for which the rate of assets to foreign capital is however erased by a high variability of a non-standard form.

The Tafler model: In spite of the correlation measured by the Spearman coefficient (18%), the results of the Tafler index can be seen as completely insufficient. The indicators related to short-term obligations and high requirements for profitability (an average holding obtained only 0.003 points for profitability indicators) influence the classification of a holding into the grey zone or directly as bankruptcy holdings. This might not be an error as a number of authors see this index as combined (bankruptcy/value); but what is unfavourable is the classification of a great deal of bankruptcy holdings as successful. Investigating the number of points for the individual parts of the index of the misclassified holdings, we have revealed that the misclassification is usually caused by the indicator of the rate of profit to short-term obligations. The unsuitability of this index can be also seen from its variability – a change of one standard deviation will change the overall value of the index to 248% of the value necessary to classify a holding as successful. Compared with the fact that an increase of the rate of short-term assets to overall assets (the indicator with the second biggest variability) of one standard deviation will change the value of the index only 0.2times (Table 7). In addition, both indicators of the assets structure and capital structure indicators are influenced – for agricultural holdings – more by the specialization of production than by the success of production itself. A difficult explicability of the individual components is a significant disadvantage of this index.

The Gurčík index: When creating his index, Gurčík dealt with specific features of agricultural holdings in Slovakia. The Gurčík index is treated as a value-owner index. It means that it is primarily used to predict the future growth of a holding. Comparing to the recommended value, the Gurčík index has classified the majority of profitable holdings into the grey zone. This classification is caused by the requested level of profitability. Gurčík considered holdings with the shareholder's capital profitability over 8% as successful. However, only three holdings

from the sample were able to keep this value during the whole five-year period. Not considering this minor disadvantage (the requirement of the fixed profitability of 8% is too high for agricultural holdings), the index is really successful. Both the index itself (the Spearman coefficient 0.31) and almost all of its components (with the exception of long-term profitability) are positively correlated to the future profit/loss (the highest correlation – almost 50% – is for the rate of cash flow to assets). Similarly, the differences in the mean values of the profitable and unprofitable holdings were proven. The relation of the value of the index to the future profitability is probably even stronger. The value of correlation is distorted by a change of the structure of the database for the indicator of long-term profitability (see notes for the Altman index). The predicative ability of the index is partially decreased only by the indicator of the supply linkage. For agricultural holdings, this indicator is more influenced by the structure of products and less by the success of a holding itself. The indicator of linkage is significantly higher for agricultural holdings with animal production (usually holdings from the areas with a higher altitude) than for holdings with plant production. Agricultural holdings with the altitude below 450 m count approximately 35 CZK of supplies to gain 100 CZK of sales revenue (it also corresponds to the Gurcík´s values for agricultural holdings in Slovakia), but for agricultural holdings with the altitude above 600 m the consumption of supplies is about by 10 CZK higher. Recalculated to the number of index points, an agricultural holding from the lowland region obtains –0.72 points for the linkage of supplies, and a holding from the submountain region obtains –0.93 points. This difference is significant for the final classification of a holding due to the low value of the remaining indicators.

It is impossible to use the index or any of its parts to predict the problems with solvency.

The Chrastinová index: This is also a Slovakian index aimed at agricultural holdings. Contrary to the Gurčík index it is considered as a bankruptcy index. Regarding this, the assessment of the index is necessary. Nor is the CH-index possible to be used in comparison with the recommended value. The majority of holdings were classified into the grey zone or as problem holdings. It is mainly caused by the long maturity dates of the obligations (possibly the impact of the large volume of obligations of Czech agricultural holdings due to the accounting of restitutions). On the other hand, only the CH-index was able to distribute more points to holdings without problems than to the holdings in danger due to the solvency fluctuation (–2.94 points for holdings without problems and –3.9 for insolvent holdings). However, these results were not statistically significant due to a high variability. The partial indicators of solvency (the value of solvency for holdings without problems reached 0.49 in comparison with 0.14 for problem holdings), of debt ratio (53% for holdings without problems compared to 63% for problem holdings) and of maturity date of obligation to a certain extent (the efficiency of this indicator is decreased by the extreme variability) can be assessed as having a positive influence. On the other hand, profitability indicators influenced the ability to predict the cash flow fluctuation in a negative way. As mentioned above, the problem holdings reached higher values of profitability than the successful holdings.

The ability to predict the development of the value of a holding is lower. The Spearman correlation coefficient reached the level of 16%. It was caused by using a solvency indicator with the negative correlation (k = 36%). The correlation of the debt ratio is actually zero and the positive influence of the maturity date of obligations is decreased by the high variability.

The index of financial health (according to the methodology of the Operational Program Agriculture): This index became the most successful identifier. Its results can be used to assess the future growth of a holding even in the absolute expression. The success of this index is caused both by the way of awarding points eliminating the extreme measures and by a large number of indicators that allows to identify all kinds of danger. The possible profitability problems were identified by the indicators of assets profitability, added value, rate of profit and the indicator of the supplies coverage. The cash flow fluctuation problems were identified by the indicators of interest maturity date (statistically significant difference), added value (unidentified), debt ratio (statistically significant difference), and current ratio statistically unidentified).

CONCLUSION

This paper presents the possibilities how the financial health indicators can be used for the prediction of the future development of a holding. We investigated both the possibility of the prediction of the growth of the shareholder's capital and the possibility of the prediction of bankruptcy. All indices under investigation have a recommended value (an interval in which a holding should range), but the comparison with this limit is actually impossible to use for agricultural holdings. On the other hand, the investigation has revealed the relation of the

value of the index to the future development for a number of indices. The calculated value of an index can be successfully compared to similar agricultural holdings (with a similar structure of production or altitude) or time.

The previously performed investigation based on the analysis of holdings that really went bankrupt revealed that agricultural holdings are in danger due to both the long-term negative profitability and by the steep fluctuation of the profit/loss followed by the negative cash flow from operations and financial insolvency. Present investigation has confirmed these results. Each of the above mentioned problems referred to a different type of agricultural holding and was identified by a different kind of an index of prediction.

The permanently low or negative profitability affects especially agricultural holdings in the mountain and submountain regions. The profit/loss of such holdings was negative but without major fluctuations. The debt ratio was low (due to the availability of bank credits) and the current ratio was high (due to animal husbandry). The main danger resulted from the inability to renew the long-term assets. Problems with long-term negative profitability were best identified by the value (owner) indices. The index of the financial health OP and the Gurčík index were highly efficient; the IN99 and the value index were efficient under certain conditions. Recommended values of these indices did not correspond with the specific features of agricultural holding but the relation of the calculated value of an index and the value of future profit/loss was proven. The Gurčík index reached the highest correlation. However, using this index is not trouble free. The value of the Gurčík index is too high for Czech agricultural holdings. Additionally, it contains the indicator of supplies linkage that predicates more about the specialization of production than about economic success.

The sudden insolvency affects especially the holdings from the lowland area that are otherwise profitable. Such holdings aimed at plant production have a high debt ratio and a lower current ratio so that they are easily affected by the sudden fluctuation of the realization prices of plant production commodities. Such sudden fluctuation causes that this kind of danger is difficult to predict. The majority of indices identified a better financial health of such holdings in comparison with the holdings without any problems. It was caused especially by the favourable profitability and activity indicators that, however, identified a high year-to-year variability for such holdings.

The Chrastinová index and the IN95 index showed the best results. These indices put more stress on the debt ratio (and partially also to the current ratio) what only can signalize the possible problems. However, it is more suitable to identify the possible danger only by the partial indicators of financial and operational analysis (a narrow specialization at plant production may also signalize a possible danger).

Factors decreasing the predicative ability of indices may be commonly divided into the following categories:

– Indicators without a relation to theredicted feature, such as the current ratio. It decreases the possibility of bankruptcy (therefore, it is suitable as a component of the bankruptcy indices) and its correlation to the future profit/loss is even negative.
– Indicators with a correlation to the predicted feature but with a non-linear relation, such as the debt ratio indicators (both for bankruptcy and value indices). It is a paradox that the debt ratio for some agricultural holdings decreases with a worse economic situation (due to the difficult availability of bank credits). The non-linear regression method could be a partial solution of this problem. A successful holding would not be identified by a limit boundary value but by the recommended interval in which an analysed financial indicator should range.
– Indicators with the correlation overweighed by another factor, such as the activity indicators. Their development more corresponds to the production specialization of a holding than to its economic success (however, the impact of the rate of assets use is important for holdings with the same structure of production). Setting the boundary criterion values for the individual production structures or recalculation of the activity indicator (due to a strong relation of the production structure to altitude) with regard to altitude (linkage of short-term assets increases approximately by 0.65 CZK per each 10 m of altitude) could be a possible solution.
– Non-standard indicators, such as the rate of the shareholder's rate to foreign capital (the Altman index) or the rate of assets to foreign sources (the IN95 index and the IN01 index; the IB value index). These indicators usually gather extreme values and significantly influence the result of the whole financial health indicator. The way of setting the number of points for a feature could be a possible solution in the case of multidimensional methods. For example, the Grunwald index limits the maximum of points that a holding can obtain for a single component of the index. The index of financial health according to the Operational Program marks features with one, two and three points.
– An unsuitable weight of the partial components of an index completes these factors in case of the

assessment of the absolute level of an indicator according to the recommended values. A high common current ratio (typical for agricultural holdings) influencing the misclassification of an unsuccessful holding as a successful one (for the IN indices, the Tafler index and the CH-index) or the indicator of a linkage of short-term assets influencing a misclassification of healthy holdings as unprofitable (for the Tafler model and the IB value index) are typical examples of such situation.

– A profit/loss of agricultural holdings is characterized by a very high variability and especially by a strong relation to external factors so that is it difficult to predict it. The development of profitability for some years under investigation reached the same direction almost for all holdings (for example, a decrease of profitability in the majority of holdings in 2000). For that reason, it is more efficient to consider the relative success of an agricultural holding (measured by its rank in the database) than the absolute value of its profit/loss. The calculation of correlations with the Spearman correlation coefficient is the solution (in addition, this coefficient leads to the elimination of extreme values).

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