The multicriterial evaluation of agricultural enterprises

Vícekriteriální hodnocení zemědělských podniku

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Abstract: A number of approaches and methods has been applied to evaluate an enterprise's success (rating) in a way to look on the firm's performance in more or less comprehensive view. The paper presents methodological tools for evaluation of the financial and non-financial characteristics, specifically the application of discriminant and cluster analysis in the case of agricultural enterprises. The methodology for total evaluation will further require the improvement in the assessment of financial and non-financial variables along with justification of their weights. The key thing is to ensure that the designed criteria for total assessment have the capabilities to assess the potential risks linked to business. That would enable to evaluate the business not only from the past and present point of view but also from the future perspective.

Key words: financial evaluation, efficiency, agriculture, discriminant and cluster analysis

Abstrakt: K hodnocení úspěšnosti podniků je využívána řada přístupů a nástrojů, které umožňují více či méně komplexní pohled na výkonnost podniku. Příspěvek představuje metodický aparát k hodnocení finančních a nefinančních charakteristik spočívající v aplikaci diskriminační a shlukové analýzy v případě zemědělských podniků. Metodologii pro komplexní hodnocení bude třeba dále upravit ve směru ohodnocení finančních a nefinančních charakteristik a jejich vah. Zejména bude nutné se zaměřit na vybrání takových kritérií, které podávají do určité míry informace o potenciálním riziku v hospodaření podniku. To umožní nejen hodnocení podniků ex post, ale také jejich budoucí vývoj.

Klíčová slova: hodnocení, efektivnost, zemědělství, diskriminační a shluková analýza

The aim of the assessment of farm results is to carry out an integrated (comprehensive) or at least relatively integrated classification which would use those criteria that are able to provide the most comprehensive view on the given farms. The classification is determined to certain extent by the purpose for which it is made. That means that the specific evaluation of enterprises may not be necessarily focused on the quantitative evaluation of the enterprises´ performance but rather to be given by the subject of the analysis, e.g. ecological. Regardless of the objectives set up in the evaluation of enterprises´ performances, the assessment itself is not to be based on one static indicator (variable) only but rather multicriterial assessment which aggregates various indicators is required (VUZE 2003). Such synthesis is has to be a comprehensive and unbiased one incorporating the appropriate scientific methods.

The financial evaluations of businesses may not provide comprehensive results because they focus on the past results mainly so it is required to incorporate quantitative (non-financial) variables into analysis which impact the farm economic results.

In general, free market system is based on such principles which should ensure whether an enterprise would survive on the market or collapse. In fact, the market (if not distorted) has been functioning as the best "arbiter" which makes it possible to decide who will win or loose. The need to intervene in the enterprise's dynamism and its functioning may call for information regarding the enterprise's evaluation. There are many situations which require the classification of the given enterprise (or a group of enterprises) in order to implement efficient policy measurement. Banks, shareholders (contemporary or prospective), exchanges, government institutions

providing supports are the institutions which want to know the rating of an enterprise based on comprehensive information. With the Czech Republic's accession to the Common Agricultural Policy (CAP), the system of farm subsidy has underwent some changes. The programs which require the farmers to process the business plan also call for a need to evaluate comprehensively the current situation of the applicants.

In the Czech Republic, this evaluation is required in submission of projects within the so-called "Operational program – The Development of Rural Areas and Multifunctional Agriculture" and also under the program focusing on rural and agricultural adjustment – "SAPARD" which allowed the application for governmental grants to be submitted till 2003. The applicants have to prove not only the quality and viability of the projects proposed but also the future perspective of their businesses as a whole. The evaluation of the farms in both programs – the "SAPARD" and the "Operational program" – regards the economic performance and also to fulfill other requirements, e.g. environmental compliance or animal welfare standards. Basically, the key aim in evaluation is to ensure that the project submitted will be carried out and finalized successfully.

The evaluation of agricultural enterprises has been so far concentrated on the assessment of main economic indicators showing how a particular dimension (economic) is developing. Either absolute, relative, residual indicators and ratios characterizing economic performance have gained their significance. Within those indicators, in particular profitability, activity, liquidity, indebtedness and productivity are the themes which may define the current state of farms. Yet, the demand for more integrated evaluation of farm situation has resulted in searching for new methods and tools how to integrate the partial indicators or produce multicriterial assessment. Methodological tools like e.g. "Spider" analysis which allows to compare the selected ratios derived from the given enterprise with some benchmarks (e.g. the whole sector) have been created. Further, there is also used a system of indicators which depends on gradual breakdown of the top indicator to the fractional indicators, possibly to the aggregated indices (Sůvová 1999).

With respect to the multifunctional model of agriculture[1], demand for multi-dimensional classification of agricultural enterprises, beside the economic dimension, is obvious. The advantage of such multidimensional evaluation is that it allows a broader classification of a farm in terms of how the farm is satisfying various standards, its role in generating public goods or participation in rural development through public activities, etc. Some research studies have concluded that all these proxies are linked to farm competitiveness. Simultaneously, it is important to state that the payments from tax payers transferred to farmers are motivated by that they (farmers`) roles in providing non-market services.

OBJECTIVES

Part of the objective of the research is to create and consequently empirically evaluate the methodological tool capable of comprehensive assessment of farms´ performance using selected variables. The assessment is to be done not only from the today's point of view but the future perspective of enterprises is to be considered in the evaluation. The general objective of the whole research is to create the applicable multidimensional (financial and non-financial aspects) robust tool for the evaluation of agricultural enterprises.

DATA APPLIED

Farm Accountancy Data Network

Data from the Farm Accountancy Data Network (FADN) have been used for years 1997–2003, so that panel data were analyzed. Later, the year 1997 was left out due to missing variables needed for the analysis in that year, so that the final time series was 1998–2003. The total number of farms amounted to 185, yet afterwards it was reduced on 183. Thus, all farms were overlapping in all years since 1998. Only legal entities (joint-stock companies, limited liability companies and cooperatives) were presented in data set.

Sample survey dealing with non-financial evaluation

In addition to the FADN, a sample survey containing 47 farms was carried out in 2004 which focused

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[1] The key elements of multifunctionality are the existence of multiple commodity and non-commodity outputs that are jointly produced by agriculture and the fact that some of the non-commodity outputs exhibit the characteristics of externalities or public goods, with the result that markets for these goods do not exist or function poorly (OECD 2001). Multifunctionality refers therefore to the fact that an economic activity may have multiple outputs and may contribute to several societal objectives at once.

on the qualitative (non-economic) characteristics of farms and of farming practices. Farms were selected randomly, so that there are farms from both less favorite regions (LFA) as well as from non-LFA regions. Potato and potato-oats production regions were among the most representative regions.

The questionnaire has been divided into 6 parts: general information about enterprises, the assets and investment activity, management and strategy, information about protection of the environment as well as animal welfare, specific questions focused on the evaluation of the enterprises and governmental supports received in 2004. The questionnaire was structured in such a way to as underpin relatively the most important non-financial factors determining the quality of running the business. Subsequently, these characteristics were applied in cluster analysis. The "key" question that characterized the selected part the most was identified in each part of the questionnaire. The following "key" questions were identified: own equity per owner (to be characteristic of the ownership structure), official price of agricultural land (to be characteristic of natural conditions), managers´ opinions on investment activity, the existence of future plans, the existence of financial indicators in future plans (to be characteristic of management and strategy), personal costs per employee, motivation of employees (to be characteristic of personal management), the share of production marketed via marketing cooperatives (to be characteristic of the production marketing), the existence of "social net" in the enterprise and the number of employees which belong to "social net" (social aspects /constraints/ of running the business), number of agro-environmental programs the farm entered in 2004, environmental aspects of entering the agro-environmental programs, the existence of business not satisfying ecological and other regulations (to be characteristic of environmental awareness), the participation of the farms in public activities. Cluster analysis has been applied using data for these questions.

METHODOLOGY

Methodological approaches in classification of enterprises using financial indicators

The fundamental task is to classify (create ratings) for the given enterprises. That requires to rank the enterprises using selected variables and to create groups membership. Two statistical (and mathematical) methods allow making the analysis sound and robust. Specifically, discriminant and cluster analysis (e.g. Bolch, Juany 1979; Lukasová, Šarmanová 1975) have been applied. The required number of groups of enterprises is defined beforehand (*a priori*) in both methods. In case of discriminant analysis, the initial classification has to be defined in advance followed by the procedure of re-classifying the groups of enterprises. In other words, the methodological procedure of the classification which affects the results is, in fact, influenced by the analysts beforehand (Rao C. Radhakrishna 1978; Ledermann 1989).

Using discriminant analysis increases the probability that the classification errors (inadequate rating and grouping) will be identified and eliminated. These errors may result from primary classification which is based mainly on experts' empirical knowledge. Though the cluster analysis may be considered to some extent as empirical method, it provides unbiased results.

Both methods (discriminant and cluster) have already been applied in the VUZE research studies dealing with the issue of enterprises' classification. In this paper, the updated research done in the field of farms' classification along with the findings obtained in previous studies is presented, so that the dynamic approach is provided.

The original evaluation of financial situation of the farms was carried out with those variables which were identified in the previous research work[2] as optimal characteristics for the evaluation of financial performance of the farms. The primary classification in the previous research used data series 1997–2000. The score was computed in a way (see below) to eliminate the time component causing the shifts in the rating of particular farms. The methodology was improved and adjusted in a certain way (e.g. time series was enlarged till 2003). Next, the methodology has been modified that the sequence weights (in time component, see Equation 2), used for total scores calculation were changed (see below). First, linear-based sequence weights have been applied in calculation followed by using geometric-based sequence weights in calculation. Further, it was decided to opt for the geometric-based sequence weights with the coefficient 0.9 so that the weights are increasing in time (the past is repressed in equation – in 1998 the weight is 0.59049 and in 2003 the weight is 1.0).

The following variables have been selected for discriminant analysis: current assets, stocks, total liabilities, short-term debts, long-term bank loans,

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[2] Final report from the research project "Financial Evaluation of Czech Farming Enterprises" in 2001, EP 9358.

depreciation, net income (loss/profit), operational assets[3], value added and investment. Each variable is expressed in Czech Crown per ha of agricultural land (CZK/ha).

Further, deciles were computed (Zwillinger, Kokoska 2000) for these four variables (primary classification): net income (profit/loss), value added, operational assets and investment. Each enterprise and variable was assigned to a particular deciles zones and connecting classification ("scoring"). The zones were then assigned the scores from 0 to 9 (zero belongs to the lowest zone, 9 belongs to the highest zone); in formula expressed as *variable_score.* Then, the annual score is calculated using the formula:

$$annual\_sco\,re_{(primary)} = \frac{(2 * net\_income\_score + 1.5 * value\_adde\,d\_score + inventory\_score + investment\_score)}{5.5} \quad (1)$$

The total score is calculated for all years applying the weights selected (weights expressed as w_r). The annual score is assigned S_r and year r.

$$total\_score = \frac{\sum\limits_{r} S_r \times w_r}{\sum\limits_{r} w_r} \quad (2)$$

The enterprises are then classified in four groups (SI_2) according to the value of the total score as follows:

Group name	Zone	Group nr
Low score	≤ 2	1
Lower- medium score	2 < rate ≤ 4	2
Higher-medium score	4 < rate ≤ 7	3
High score	> 7	*4*

(in the text below, these zones are referred to as "original zones" SI_2)

That resulted in four groups of enterprises. The groups are labeled with codes from 1 (let us call them provisionally "unsuccessful") to 4 (let us call them provisionally "successful"), as shown above. Next, discriminant analysis for the selected years was applied for that classification (4 groups) in order to make a comparison. The following 8 variables have been employed[4]: current assets, stocks, short-term debts, long-term bank loans, revenues from goods and services sold, value added, depreciation and net income (profit/loss). Therefore, primary discriminant analysis was calculated using 8 variables (factors) for 2003 and the original classification (rating) was calculated using total scores from the years 1998–2003.

In the next steps, the results achieved from discriminant analysis have brought about the needs for the methodology to be further modified. The partial scores and weights were unchanged but the variables involved were modified in this way[5]: net income (profit/loss), value added, operational assets and investment. That means, the variables employed were among those being implemented in the primary classification. Discriminant analysis has resulted in the improvement in the final classification (grouping) which means the results we achieved corresponded more with the primary classification (on the contrary to the classification based on 8 variables). In fact, such result was more or less expected. It should be stated that the approach using 4 variables is less statistically significant then the one applying 8 variables (factors). However, that does not necessarily mean that the slight deterioration in classification resulting from discriminant analysis with 4 variables is unsuitable or wrong. On the contrary, the comparison of results obtained using various numbers of variables or different methods may contribute to the analysis as a whole, so that all approaches were taken into consideration in further classifications.

The results have proved (Wilks lambda and other tests) that short-term obligations have only insignificant effect on discriminate function (meaning final classification). Therefore, in the next step the variable – short-term debts – was left out and the value of investment was applied instead. At the same time, the analysis raised the question about justification of which variables are to be suppressed or preferred in annual score equation (eq. 1). It was shown that the value added should be given preferential rate at the expense of net income (profit/loss). There is no strong correlation between these two variables and for the purposes of comprehensive enterprises´ classification, value added seems to characterize the farms´ performance better than the indicator of net income. Scores for the particular years were then constructed as follows:

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[3] Current assets minus short-term debts, current bank loans, other short-term debts.

[4] Hereafter, this methods assigned "Estimated group DA 8".

[5] Hereafter, this methods assigned "Estimated group DA 4".

$$\text{annual\_sco re}_{(new)} = \frac{(\text{net\_incom e\_rate} + 2 \times \text{value\_adde d\_rate} + \text{inventory\_rate} + 0.5 \, \text{investment\_rate})}{4.5} \qquad (3)$$

No other changes were done in the formula except the annual scores calculation. Please note, that the total score was calculated using geometric-based sequence weights with a coefficient 0.9.

In the further phase of analysis, the zones which define the enterprise group membership were discussed. The classification into zones highlighted average businesses as seen in Figure 1.

The primary classification (using *SI_2* zones) and consequently the classification done by discriminant analysis has shown that the most frequent groups were 2 and 3 meaning lower-medium and higher-medium, respectively. Only few farms were group members 1 ("unsuccessful") and also group members 4 ("successful").

Due to the unbalanced distribution of the enterprises over the groups, the zones for group membership were improved (SI_1) as follows:

Group name	Zone	Group nr.
Low score	≤ 3	1
Lower-medium score	3 < rate ≤ 4.5	2
Higher-medium score	4.5 < rate ≤ 6	3
High score	> 6	4

(in the text below these zones are referred to as "improved zones")

The groups are labeled again with codes from 1 ("unsuccessful") to 4 ("successful"). Nevertheless, there is no empirical evidence which zones are statistically more appropriate. The final decision regarding which option (zones) to select is to some extent affected by the researchier's expertise in the rating issue. It had to be decided which type of farms would be considered as "successful" or "unsuccessful" – are they outliers (being group members 1 and 4) or shall we want to have farms over groups equally distributed. It would be a bit risky to reckon on one distribution of farms over the groups. So that in the next phase, both zones (original and improved) were employed in the analysis along with the modified annual scores (new). The option which consists of the original zones and new annual scores (Eq. 3) were labeled as *SI_2*. At the same time, discriminant analysis for this option was further processed using both 4 variables (factors) and then 8 variables (see above). Both linear and canonical discriminant analysis was applied.

The initial discriminant analysis has been computed (as stated above) using data from 2003 and the total score based on variables from the whole time series. To have an insight into the classification of farms over the years, discriminant analysis was processed also with the data from 2001 and 2002. Yet, the initial
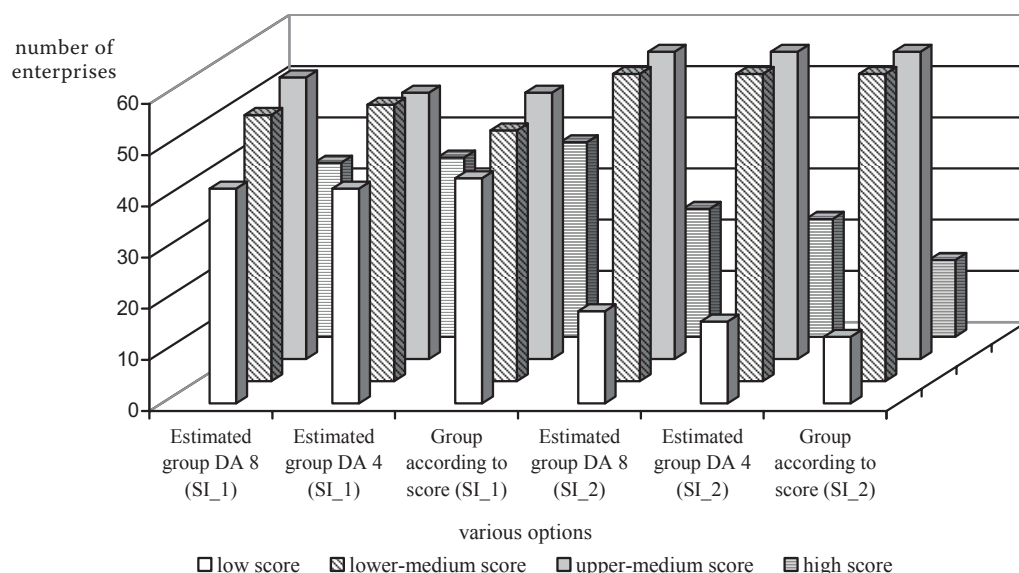

Figure 1. Distribution of enterprises according to various options

Estimated group DA 8: enterprises grouped using discriminant analysis with 8 factors
Estimated group DA 4: enterprises grouped using discriminant analysis with 4 factors
SI_1: the enterprises assigned to groups using the "improved zones" (see below)
SI_2: the enterprises assigned to groups using the "original zones" (see above)
Source: own graph

Table 1. Basic characteristics for estimated statistical groups

Characteristics	Variant	Low score	Lower-medium score	Higher-medium score	High score
Total agricultural land[1]	DA 8 (SI_1)	1 237.6	1 554.0	1 521.6	1 912.3
	DA 8 (SI_2)	1 440.0	1 450.9	1 607.3	1 700.7
	DA 4 (SI_1)	1 247.1	1 573.1	1 488.5	1 860.1
	DA 4 (SI_2)	1 447.0	1 568.3	1 456.6	1 755.9
	Score group (SI_1)	1 307.5	1 460.8	1 596.3	1 794.4
	Score group (SI_2)	1 285.8	1 591.0	1 469.5	1 914.9
Number of workers (AWU)[2]	DA 8 (SI_1)	76.15	93.21	120.17	185.87
	DA 8 (SI_2)	80.70	96.86	122.46	158.97
	DA 4 (SI_1)	82.88	95.02	117.38	171.87
	DA 4 (SI_2)	78.05	105.59	116.10	162.54
	Score group (SI_1)	80.06	90.10	122.88	171.64
	Score group (SI_2)	68.19	106.56	114.76	176.15
Total assets	DA 8 (SI_1)	38 722	34 682	52 037	79 258
	DA 8 (SI_2)	31 333	39 766	50 361	71 542
	DA 4 (SI_1)	41 352	35 278	49 680	78 243
	DA 4 (SI_2)	30 862	40 996	49 496	73 738
	Score group (SI_1)	30 774	34 289	51 210	83 676
	Score group (SI_2)	26 128	40 788	51 171	77 406
Own capital	DA 8 (SI_1)	4 025	12 022	25 748	38 210
	DA 8 (SI_2)	5 619	14 943	24 884	38 901
	DA 4 (SI_1)	3 860	13 449	23 140	43 365
	DA 4 (SI_2)	5 258	16 828	21 682	42 704
	Score group (SI_1)	−191	13 064	24 120	45 203
	Score group (SI_2)	3 535	15 517	24 836	42 068
Long-term debts	DA 8 (SI_1)	12 344	14 088	14 255	24 015
	DA 8 (SI_2)	13 139	16 217	14 397	15 746
	DA 4 (SI_1)	15 209	13 043	15 279	18 423
	DA 4 (SI_2)	11 898	15 603	16 190	15 301
	Score group (SI_1)	19 038	13 284	15 640	13 906
	Score group (SI_2)	13 637	16 540	15 378	12 973
Short-term debts	DA 8 (SI_1)	20 713	5 682	6 124	6 446
	DA 8 (SI_2)	10 315	5 144	6 345	6 620
	DA 4 (SI_1)	20 777	5 487	5 702	6 434
	DA 4 (SI_2)	11 157	5 359	6 059	6 124
	Score group (SI_1)	10 141	5 093	5 643	14 088
	Score group (SI_2)	6 907	5 414	6 237	10 963

Characteristics	Variant	Low score	Lower-medium score	Higher-medium score	High score
Total bank loans	DA 8 (SI_1)	1 550	2 411	5 391	8 944
	DA 8 (SI_2)	1 750	3 146	4 473	8 905
	DA 4 (SI_1)	1 443	2 744	5 107	8 680
	DA 4 (SI_2)	1 894	2 965	5 141	8 433
	Score group (SI_1)	1 418	2 410	5 317	9 198
	Score group (SI_2)	1 361	3 158	4 184	10 314
Long-term bank loans	DA 8 (SI_1)	387	1 980	4 505	6 979
	DA 8 (SI_2)	1 096	2 702	3 567	7 442
	DA 4 (SI_1)	383	2 288	4 315	6 747
	DA 4 (SI_2)	1 287	2 476	4 252	6 859
	Score group (SI_1)	894	2 104	4 366	7 015
	Score group (SI_2)	992	2 841	3 124	8 462
Ouptup	DA 8 (SI_1)	15 844	16 423	28 911	44 249
	DA 8 (SI_2)	13 681	20 263	28 461	39 194
	DA 4 (SI_1)	15 743	16 691	28 632	42 495
	DA 4 (SI_2)	13 991	19 563	29 574	39 496
	Score group (SI_1)	12 333	16 954	28 582	45 259
	Score group (SI_2)	12 425	19 706	29 752	40 625
Intermediate consumption	DA 8 (SI_1)	14 372	12 684	19 079	26 714
	DA 8 (SI_2)	11 994	14 188	18 697	24 913
	DA 4 (SI_1)	15 295	12 638	18 758	26 085
	DA 4 (SI_2)	12 677	13 701	19 356	24 660
	Score group (SI_1)	12 723	12 585	18 786	28 178
	Score group (SI_2)	11 385	13 643	19 862	25 349
Value added	DA 8 (SI_1)	1 614	3 783	10 016	17 675
	DA 8 (SI_2)	1 740	6 141	9 847	14 641
	DA 4 (SI_1)	563	4 118	10 060	16 539
	DA 4 (SI_2)	1 369	5 949	10 468	14 937
	Score group (SI_1)	−282	4 402	9 994	17 282
	Score group (SI_2)	1 094	6 116	10 146	15 408
Operating capital	DA 8 (SI_1)	−6 532	6 377	12 929	25 032
	DA 8 (SI_2)	674	9 012	12 068	20 605
	DA 4 (SI_1)	−6 792	6 252	13 120	24 109
	DA 4 (SI_2)	−186	8 793	12 180	22 326
	Score group (SI_1)	103	7 107	13 178	17 912
	Score group (SI_2)	2 435	8 675	12 914	18 182

[1, 2] Expressed in average per farm

classification which was based on the total scores was calculated from the whole data series (1998–2003). Discriminant analysis results for the given scores are presented in the Table 1.

Methodological clarification of cluster analysis

Data collected from the specialized sample survey dealing with non-financial variables were mostly qualitative ones. So that, to use cluster analysis is to be the best option. The main feature is to divide the sample into 4 clusters, which would enable to compare them with the groups created by discriminant analysis. In other words, it searches for the correlation (direct or indirect proportion) among groups created. Nevertheless, only some of the enterprises participating in the specialized sample survey were overlapping with those being in the FADN database. That is why the scores and groups membership were estimated using discriminant function derived from the analysis for those farms which were not involved in the FADN database. Discriminant function was that for 2003 calculating the improved zones and 8 variables (factors). Cluster analysis calculated by the median method was chosen as it distributed enterprises over groups the best.

DISCUSSION

The evaluation of financial indicators according to group membership

First, the enterprises having high total scores have been cultivating at the same time, in average more ha of land and employed, in average, more workers (AWU) as shown in Figure 2. It has impacted the financial results of those farms. Table 1 shows the distinct differences existing over the four groups created. It is hypothesized the farms with high (higher-medium) scores are intensive oriented farms and *vice versa* (the value of assets, own capital, revenues from goods and services sold, value added is 2 times, 8–10 times, 2–3 times, 14 times, respectively, higher on farms with high total scores compared to low total scores members). Yet, there is no difference for long-term debts. Net income (profit/loss) is varying below zero (loss) over all groups. As total scores increase, the farms have also the potential to increase the total investments.

Looking at the selected indicators derived from the financial analysis, the analogous development among the groups can be identified – the profitability is increasing as the scores are improving and, on the contrary, the total indebtedness has a diminishing
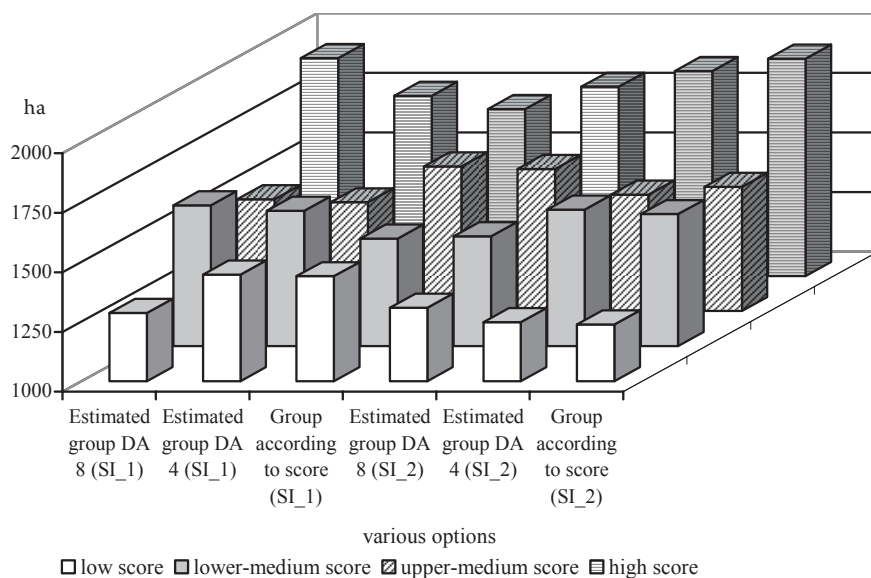

Figure 2. Average area of operated agricultural land according to various options (ha)

Estimated group DA 8: enterprises grouped using discriminant analysis with 8 factors
Estimated group DA 4: enterprises grouped using discriminant analysis with 4 factors
SI_1: the enterprises assigned to groups using the "improved zones" (see below)
SI_2: the enterprises assigned to groups using the "original zones" (see above)

Source: own graph

slope as the total scores increase. Nevertheless, the amount of bank loans is higher as far as the scores are increasing (in "better" groups). It shows that the enterprises having better financial indicators may afford larger indebtedness. The share of value added in personal costs (incl. social and health payments) has indicated in the enterprises with low scores that the value added generated is not sufficient to cover the personal costs incurred during the production (only 75% of personal costs are covered by value added). On the contrary, those enterprises with high scores have generated such value added enabling to cover the personal costs amounting to 130%.

Though the quality of results obtained from primary classification and discriminant analysis between the various options (scores, zones) may not have varied significantly, the best option to be chosen is the discriminant analysis with 8 variables. Kruskal-Wallis one-way Analysis of Variance (ANOVA) and pairwise multiple comparisons tests (Tukey HSD; N-S-K; *t*-test; Dunn; Dunnet) can determine which means differ (Kendall, Stuart 1986). The groups created using all discriminant analyses processed along with the groups achieved from primary classification were compared among themselves. Small datasets with discrete data were used. Thus, non-parametric tests which do not require the specific distributional assumption were applied. Yet, there is no simple agreement over the robustness of the methods used (Huber 1981). However, due to relatively large scale of sample, the methods applied for comparison of groups are statistically significant and provide solid ground for the analysis.

Generally, the results obtained from discriminant analysis have shown that they did not differ significantly among themselves, so that the approaches adopted do not come up with significant different outcomes, in particular, in 2003. Multicriterial comparison based on *t*-distribution has disclosed the differences existed between results coming up from primary classification (with original zones) and results derived from discriminant analysis using improved zones for both 8 and 4 variables. In principle, opting for the given method of discriminant analysis has to be anticipated (*a priory*) using the subject analysis. The particular results raised from the comparisons have supported the idea to opt for the improved (new) zones (more equally distributed enterprises) and using 8 variables.

Synthesis of financial and non-financial evaluation

Results from discriminant and cluster approaches and their analysis enable us to make a comprehensive classification of the enterprises from both financial and non-financial perspectives. However, there was found weak correlation between financial results and the selected non-financial ones. It still has to be born in mind, that both indicators (financial and non-financial) actually characterize different matters in business behavior. So far, it was identified that the correlation between these two dimensions (perspectives) does not exist. It was proved by correlation analysis. Yet, more research and analysis incorporating more other non-financial variables has to be done to make comprehensive conclusions. Also, the extent and representativeness of non-financial data set has to be taken into account while forming conclusions. Unlikely to the FADN dataset, the sample survey consisting of non-financial data was limited in extent and may not sufficiently overlap with the financial database.

CONCLUSION

The partial results derived from the analysis so far will be followed by further elaboration. Thus, the methodology will go through the changes as already outlined above. The following conclusions may be formulated:

Looking at the calculations processed the best option for classification of the enterprises seems to be discriminant analysis using the variables: current assets, stocks, long-term bank loans, value added, revenues from goods and services sold, depreciation, net income, investments (before deducting subsidies).

The initial classification required for discriminant analysis is constructed using total scores which are based on annual scores emphasizing "artificially" the variable of value added. The improved zones for enterprises' membership seem to be beneficial and justifiable.

For the classification (rating), there is used linear discriminant analysis. As far as the data for new enterprises are available, canonical discriminant analysis may be applied for group membership.

The results achieved so far will be further updated incorporating new data – it concerns discriminant analysis as well as additional statistical aptitude tests.

Cluster analysis has shown to be a suitable method for the non-financial data analysis. Yet, to undertake other options (methods) of cluster analysis in order to verify the results is needed as well as using better databases and maybe more justifiable variables. After that, the results will be more likely based on a solid ground. At the same time, the attention will have

to be paid to the identification of right relationship between cluster analysis outcomes and the results coming up from financial analysis.

The methodology for total evaluation will further require the improvement in the assessment of financial and non-financial variables along with the justification of their weights. The key thing is to ensure the designed criteria for the total assessment have the capabilities to assess the potential risks linked to business. That would enable to evaluate the business not only from the past and present point of view but also from the future perspective.

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