FINANCIAL PERFORMANCE EVALUATION OF THE CZECH AGRICULTURAL COMPANIES WITH FACTOR ANALYSIS

Jana Hornungová, František Milichovský

Abstract: *The article is focused on determination of the financial indicators influencing corporate performance of agricultural companies. Traditional financial indicators (calculated from accounting data) are still used to evaluate performance level; this approach to evaluation and comparison of performance has been considered to be the most appropriate approach over a long period of time in spite of different accounting and financial indicators. Data from 1985 agricultural companies have been analysed. Correlation analysis and factor analysis have been employed to eliminate information duplication and reduce dimensionality. Application of these methods has reduced the basic set, originally formed by thirteen key financial indicators, into three key groups (indexes): operational factor, profit factor and return factor. At the same time, Pearson's chi-square test has indicated the dependency between the above mentioned factors (indices) and company size; the most significant factor being the "operational factor" with the strongest power in relation to the company size.*

Keywords: *Financial performance, Indicators, Factor analysis, Factor indexes, Agricultural companies.*

JEL Classification: *L21, L25, Q14.*

Introduction

Economic results, reported by the Czech agricultural sector in 2014, achieved an above -average positive outcome. The survey, made by the Agricultural Association of the Czech Republic based on the accounting data, suggested that the entire agriculture showed the profit amounting nearly to CZK 19 milliard (5331 CZK/ha). The value is more than twice as high as the long-term average of the economic results achieved in the years 2004-2014, reaching the sum of CZK 2400 CZK/ha, as the investigation of Agricultural Association of the Czech Republic confirmed.

The main driving forces behind strong results have been mainly the external factors, i.e., a very rich harvest and reasonable prices for animal commodities. As estimated, year-to -year agricultural production has increased by 4.8 %, mostly due to the record crop of corn and oil-seed rape. Higher animal production has not contributed to better results; on the contrary, increase in prices, especially for milk, as well as cattle, pigs and eggs. Despite good prices for animal commodities the prices for farmers (as the weakest link in the agriculture economic competition chain) were nearly by 4% lower in year 2014 compared to 2013 (with the vegetable production prices reporting the sharpest decrease, by more than 10%). Furthermore, volume of agriculture aid significantly influences the economic results. Comparing the sum of main agricultural aids (nearly CZK 30 milliard) and profit for the year 2014, i.e., CZK 19 milliard, it is rather clear that the Czech farming is profitable through these aids. Without such aids the Czech agriculture would report ca. CZK 11 milliard loss, or the food prices would have to be much higher in the Czech Republic [26].

Financial performance evaluation, including economic results, constitutes an important part of company management, as the evaluation figures help us to monitor and evaluate accomplishment of the basic economic objectives [27], [18].

1 Theoretical background

Recently, performance evaluation methods have significantly changed. Performance evaluation can be defined as the ability of a company to boost investments, put into business activities, contributing to continuous self-improvement and accomplishment of business objectives [23], [13], [15].

Performance evaluation is one of the tools helping the company management to decide how to do the business activity effectively [1], [12].

However, according to Tyrychtr, Ulman and Vostrovský [25] agricultural holdings predominantly focus on technical performance (more than 50% of all companies), only then on financial performance. At the same time, share of companies targeted at the efficient economic agriculture is increasing. Nevertheless, the level of this efficiency is below 13%.

Traditional financial indicators (calculated from accounting data) are still used today to evaluate performance; this approach to performance evaluation and comparison has been recognized as the most appropriate for a long period of time in spite of different accounting and financial indicators. Since 1980 traditional methods have been facing various views, identifying contentious issues in the use of these models, resulting in the search for other opportunities for performance evaluation [16], [14].

Over the time, the performance has been measured either by the company size or its productivity and profit. The scientific literature divides financial indicators of the company performance into three categories:

- ***Accounting results and derivative indicators*** – the accounting result is the result from the financial statement. The basic indicator, which can be explained by means of the structural analysis of the profit and loss statement. Accounting indicators express the company's performance in absolute values. The application of these indicators is recommended for various comparisons: proportion of personal costs to turnover; productivity rate; proportion of business margin to turnover, etc. These indicators provide a clear picture of productivity [2].
- ***Traditional production indicators (indicators of financial productivity)*** – these indicators provide information through the value of invested assets. The best known indicator is ROI (return on investment), calculated as the ratio of the economic result to the cost of investment. Another traditional productivity indicator is the ratio of the net economic results to the equity capital (ROE = return on equity). Ratio indicators of financial productivity provide information helping the company to compare its productivity, expected by shareholders, i.e., to evaluate so-called financial attractiveness.
- ***New category of financial indicators*** – represented by the metrics EVA (Economic Value Added); its positive value indicates that from purely financial point of view the company has successfully generated value after the payment of all capital investments, in particular from capital shareholders [17].

Areas of concern, related to the management, investors and creditors see the following Table 1, completed with the most frequently used methods of performance measurement.

Tab. 1: Performance indicators according to segments and perspectives

Management, Operational analysis	Gross margin Profit margin Added value	Net revenue result Structural analysis Revenue leverage
Investors/Shareholders productivity	Social capital productivity Earnings per share Cash flow per share	Net assets productivity Share quotation increase
Creditors, Liquidity	General liquidity Acid test	Liquidity value
Resource management	Stock turnover Receivables turnover	Suppliers turnover Asset turnover
Profit usage	Dividend per share Dividend ratio Distribution/un-allocation ratio	Dividend-coverage degree Dividends/Total assets
Financial leverage	Leverage degree Financial stability	Financial autonomy
Productivity	Economic value added Economic profit Cash-flow productivity	Gross productivity Net assets productivity Economic productivity (net)
Market performance	Value vectors Company value Accounting value	Value on market Relative movements of quotations
Debt service	Fixed-expenses coverage degree Cash-flow analysis	Interest-coverage degree Debt-coverage degree

Source: [7]

"Profit and loss statement", representing the influence of managerial operational decisions on the economic results of the company, has been used to study company performance (in this case the information whether the company generates profit or loss). In consideration of these results the balance must be extended to clarify certain important elements in the modification in the shareholders' capital with the aim to offer more detail information necessary to measure performance in company. Information related to the company's performance, especially as regards its productivity, is used for:

- evaluation of potential modifications of the company's economic resources in a way to be influenced in the future. Information related to performance and mainly the ability of its change are immensely important for decision-making process, e.g., the ability to forecast cash flows from the existing resources;

- declaration on efficiency in the use of new resources [17].

On the basis of its theoretical framework this article focuses on the financial indicators of agricultural companies in the Czech Republic, forming the part of financial performance. Data contained in the database Amadeus will be analysed by the factor analysis.

2 Methods

The main aim of this paper is to find crucial factors in the field of financial performance in agriculture companies (as one of the most important industry sector). Partial aim of the paper is to identify relationship between *observed factors* and *company size*.

Main hypothesis suggests dependence between realization of individual activities and their performance in connection with agriculture. Agriculture has become the very important part of industry production in the past. Data have been gathered from Amadeus database and processed by the statistical program IBM SPSS Statistics 22; subsequently, (1) factor analysis, and (2) dependency between two nominal variables by means of contingency tables and Pearson's chi-squared test have been studied.

The conditions for choice of companies:

1. geographical location (Czech Republic),
2. classification of economic activities according to CZ-NACE, reduced to agriculture sector (see Table 2).

According to selected NACE groups, the basic population has been defined, consisting of 2544 agriculture companies in the Czech Republic. Only 1985 companies have reported all required data to be used for investigation (see Table 2).

Tab. 2: Pivot table: company size and CZ-NACE groups

CZ-NACE	Company size				Total
	Micro	***Small***	***Medium***	***Large***	
1 – Crop and animal production, hunting and related service activities	762	745	288	4	1799
2 – Forestry and logging	85	63	14	1	163
3 – Fishing and aquaculture	6	11	6	0	23
Total	853	819	308	5	1985

Source: authors

Factor analysis is based on the selection of correlation and partial correlation coefficients. The correlation coefficient represents the closeness of linear dependence of individual variables and partial correlation coefficients. The partial correlation coefficient shows a similarity of two variables in such a situation that the other variables are assumed constant. If it is possible to explain the dependence of variables using common factors, the partial correlation coefficients are very small, close to zero. To assess the suitability of the factor analysis, two tests can be used [24], [4]:

- Kaiser-Meier-Olkin (KMO) is a coefficient which could reach values between 0 and 1. Its value consists of the rate of squares sum of the correlation coefficients and squares sum of the correlation and partial coefficients.

- The use of Bartlett's sphericity test lies in testing the null hypothesis stating that the correlation matrix of variables is unit (on diagonal, there are only ones, others are zeros). If the null hypothesis is rejected, the factor analysis may be used for the defined variables.

For the purposes of verification of the factor analysis Cronbach's alpha indicator must be used. This indicator is understood as a reliability coefficient, used as a kind of analogy with the correlation coefficient. Normally, values oscillate in the interval <0, 1>. Zero, as the extreme value, describes the situation in which individual variables are uncorrelated. On the other hand, the value 1 describes correlated variables. When the value is closer to 1, a higher degree of conformity is reported [9], [5], [21].

However, high Cronbach's alpha does not imply that the measure is dimensionless. If, in addition to measuring internal consistency, you wish to provide evidence that the scale in question is dimensionless, additional analyses can be performed. Exploratory factor analysis is one of the method to check dimensionality. Cronbach's alpha is not a statistical test; it is a coefficient of reliability (or consistency). The value could be expressed as the function of number of test items and the average inter-correlation among the items. Below, for conceptual purposes, we show the formula for the standardized Cronbach's alpha:

$$\alpha = \frac{N \times \bar{c}}{v + (N + 1) \times \bar{c}} \tag{1}$$

where

N equals to the number of items,

c-bar is the average inter-item covariance among the items,

v-bar equals to the average variance.

If the values increase the number of items (N), it is possible to increase Cronbach's alpha. Moreover, if the average inter-item correlation is low, the alpha will be low, too. As the average inter-item correlation increases, Cronbach's alpha increases as well. The values of Cronbach's alpha could be from 0 to 1. If the values are close to 0.5, it signifies a bad level of internal consistency. Over 0.7 means that the value is acceptable and values close to 1 are excellent. A "high" value of the alpha is often used (along with substantive arguments and other statistical measures) as evidence that the items measure an underlying (or latent) construct [8].

3 Results

According to analysis of results, it is evident that companies commonly use traditional financial indicators for measurement of their own effectiveness. Based on the analysis of descriptive statistical characteristics of the sample (see Table 3), conclusions will be presented merely as an explorative result limited by the resultant reliability. In the results of the paper there are characteristics of research barriers and future research possibilities.

Tab. 3: Descriptive statistics of variables

	Units	***Mean***	***Std. deviation***	***Variance***
x_1 – Cash flow	*[th EUR]*	346.78	606.23	367512.93
x_2 – P/L before tax	*[th EUR]*	167.06	467.44	218503.70
x_3 – Operating revenue	*[th EUR]*	2537.87	5239.57	27453062.23
x_4 – Sales	*[th EUR]*	2031.85	4910.34	24111398.72
x_5 – EBIT	*[th EUR]*	188.79	441.62	195026.36
x_6 – P/L after taxes	*[th EUR]*	134.79	387.20	149923.01
x_7 – ROA	*[%]*	4.76	11.34	128.67
x_8 – EBITDA	*[%]*	16.23	14.65	214.76
x_9 – Profit margin	*[%]*	5.51	13.04	170.06
x_{10} – Profit per employees	*[th EUR]*	6.45	19.27	371.42
x_{11} – ROCE	*[%]*	12.43	37.06	1373.54
x_{12} – ROE	*[%]*	14.14	45.96	2112.22
x_{13} – Average costs of employees	*[th EUR]*	11.26	8.43	71.10

Source: authors

Based on the statistical characteristics of the examined group the conclusions could be presented as an approximate result, limited by the resulting reliability. In the results of the paper there are characteristics of research barriers and future research possibilities.

For the purpose of factor analysis the value of Kaiser-Meier-Olkin test should reach the value of at least 0.5. For the indicators in factor analysis KMO is 0.737 (high level of acceptance). Factor analysis reveals the reduction in surveyed company performance indicators which companies use in their own measurement processes. Factor analysis shows the reduction in surveyed company performance indicators which companies use in their own measurement processes of implemented innovations. The main input into factor analysis has been the correlation matrix, illustrating individual correlation values of the chosen indicators.

Tab. 4: Correlation matrix

	Cash flow	*P/L before tax*	*ROCE*	*ROE*	*Operating revenue*	*Sales*	*EBIT*	*P/L after tax*	*ROA*	*EBITDA*	*Profit margin*	*Profit per employees*	*Average costs of employees*
Cash flow	1												
P/L before tax	0.941	1											
ROCE	-0.021	0.020	1										
ROE	-0.015	0.021	0.606	1									
Operating revenue	0.638	0.559	-0.019	-0.023	1								
Sales	0.562	0.498	-0.012	-0.017	0.992	1							
EBIT	0.941	0.977	0.017	0.017	0.584	0.520	1						
P/L after taxes	0.933	0.995	0.024	0.025	0.554	0.494	0.965	1					
ROA	0.160	0.271	0.167	0.147	0.013	0.009	0.256	0.286	1				
EBITDA	0.245	0.270	0.030	0.031	-0.092	-0.122	0.285	0.281	0.517	1			
Profit margin	0.283	0.390	0.110	0.104	-0.005	-0.025	0.361	0.410	0.769	0.748	1		
Profit per employees	0.188	0.274	0.110	0.072	0.017	0.011	0.262	0.289	0.523	0.469	0.644	1	
Average costs of employees	0.142	0.118	0.009	-0.010	0.081	0.070	0.123	0.120	0.088	0.087	0.134	0.312	1

Source: authors

According to correlation matrix there were found that exist closed relationship between almost all variables, except Average costs of employees. These variables were used such input into method of principal components gives for calculation.

Factor analysis gives up reduction of surveyed company performance indicators which companies use in own measurement process. The main input into factor analysis has been the correlation matrix showing the position of the individual selected correlation values. The values, listed in the Table 4, indicate that correlations exist in nineteen relations, as highlighted.

The total variance of the performance indicators is explained by means of eigenvalues, representing the total variance explained by each factor. The eigenvalues show that only five items have reached the minimum value of 1. From this point of view, Extraction Sums of Squared Loadings with cumulative percentage are important. Factor analysis has extracted four factors, which explains 81.406 % of the variance. This result confirms the good factor result of the interpreted variance.

In order to assess whether it is possible to use the factor analysis, Kaiser-Meyer-Olkin method (KMO) and Bartlett's test of sphericity have been used. The KMO method is based on selective correlation and partial correlation coefficients. The KMO value range is between 0 and 1. In our case, the KMO reached value is 0.737, which means that the performed level of usefulness of the factor analysis reaches high value. Bartlett's test of sphericity is a statistic test used to examine the hypothesis that the variables are correlated or uncorrelated. According to the KMO, no correlation has been found with other variables (Sig = 0.000). Nevertheless, Bartlett's test of sphericity is significant because of the value, lower than 0.05 (see Table 5).

Tab. 5: Indicators of innovation measurement in the company – rotated matrix

	Operational factor (OF)	***Profit factor (PF)***	***Return factor (RF)***	***Average cost per employee factor***
Cash flow	0.933	0.194	-0.051	-0.026
P/L before tax	0.915	0.310	-0.011	-0.068
Operating revenue	0.826	-0.255	0.038	0.270
Sales	0.777	-0.283	0.053	0.293
EBIT	0.919	0.289	-0.015	-0.054
P/L after taxes	0.907	0.326	-0.008	-0.063
ROA	0.096	0.779	0.167	0.070
EBITDA	0.076	0.825	-0.056	-0.078
Profit margin	0.164	0.913	0.063	0.045
Profit per employees	0.090	0.715	0.061	0.409
ROCE	-0.009	0.080	0.889	0.012
ROE	-0.003	0.065	0.888	-0.038
Average costs of employees	0.053	0.155	-0.038	0.869

Source: authors

Acceptable values of Cronbach's alpha have been specified for three indexes according to observed results in Table 5: (1) operational factor (0.705), (2) profit factor (0.830) and (3) returns factor (0.770). Cronbach's alpha value for the last factor could not be calculated because of the only one indicator included. Final values calculating acceptable factors need the transformation of individual coefficients. These coefficients express significance of the used elements. Their sum total must be 1. The individual factor indices have been defined by the procedures as follow:

$$OF = 0.1825 \times x_1 + 0.1885 \times x_2 + 0.1315 \times x_3 + 0.1210 \times x_4 + 0.1877 \times x_5 + 0.1887 \times x_6 \quad (2)$$

$$PF = 0.2496 \times x_7 + 0.2489 \times x_8 + 0.2743 \times x_9 + 0.2272 \times x_{10} \quad (3)$$

$$RF = 0.4991 \times x_{11} + 0.5009 \times x_{12} \quad (4)$$

These indices can be calculated for the individual agricultural company and on the basis of their results a list of businesses can be compiled. Indices can determine important factors of business, playing the key role in achieving the set of objectives. Proposed financial performance indicators should help companies to demonstrate a progress towards the objectives of sustainability. Also we can see basic statistics of observed indexes in Table 6.

Tab. 6: Descriptive statistics of observed indexes

	OF	***PF***	***RF***
Mean	753.7985	2329359.810	13.4859
Variance	8.4961	119.561	1285.495
Std. deviation	1526.22404	10.93440	35.85380

Source: authors

Pivot tables have been employed to find possible dependencies between observed factors and company size. Results of the dependency tests (see Table 7) examining dependence between individual factors and impact of company size. Results of the dependence examination in individual variable categories are depicted in the following results of Pearson's chi-square test.

Maintaining the % reliability of the test, the values for connection between individual factors and company size have been determined within 0.05, which represents 5% reliability level. Established values of α for the variables are: $\alpha_{OF} = 0.000$; $\alpha_{PF} = 0.000$, $\alpha_{RF} = 0.000$ (i.e., less than 0.05). Therefore, that bring us to the conclusion that an alternative hypothesis is applied – there are dependencies between all observed factors and company size.

Past results have revealed the relationship between company size and indices. Subsequently, degree of such dependence has been examined. To that end, the intensity of dependence determined by means of contingency coefficient.

Tab. 7: Pearson's test of the relationship between individual factors and company size

		Value	*Asymp. Sig. (2-sided)*
Operational factor and company size	Pearson Chi-Square	769.016	0.000
	Contingency Coefficient	0.548	
Profit factor and company size	Pearson Chi-Square	67.046	0.000
	Contingency Coefficient	0.195	
Return factor and company size	Pearson Chi-Square	70.985	0.000
	Contingency Coefficient	0.267	

Source: authors

The intensity of dependence ranges between <0;1>. That means that the higher the absolute value, the greater the intensity of dependence. For the first connection (operational factor and company size) the value 0.548 has been calculated, i.e., the intensity inclines to be strong. For the second connection (profit factor and company size) the value 0.195 has been calculated, i.e., the intensity inclines to be rather low. For the third connection (return factor and company size) the value 0.267 has been calculated, i.e., the intensity inclines to be low.

Conclusion

Financial performance evaluation employs traditional indicators, utilizing accounting data of the company. The advantage of such indicators is a relatively easy traceability as such data constitute the part of obligatory reporting (financial statements, balance and profit/loss statement form the part of annual balancing). With respect to the fact that the press release, published by Agricultural Association, has published the information related to the economic results of the Czech agriculture sector, the research itself has focused on the area of economic results, i.e., financial indicators. Earlier studies (e.g. [6], [19], [3]) describe the diversity of financial indicators based on peculiarities of the company's activities. Along with the traditional financial indicators: revenue growth, return on equity and EBIT, gross operating profit, net operating profit and sales achieved, etc. Financial performance indicators include such indicators as market share [10] and sales growth [20], which are described by researchers' opinions as the indicators of growth or competitiveness.

Financial indicators are frequently expressed as financial ratios. Ratios are a strategic management tool providing the key stakeholders with a concise and systematic way to organize the voluminous data contained in financial statements (e.g., balance sheets, income statements, and statements of cash flows) into meaningful information. Financial ratios refer to the numerical or quantitative relationship between two items or variables. This relationship can be expressed in various terms such as percentages or fractions [22], [11].

The main aim of this paper has been to find crucial factors in the field of financial performance in agriculture companies and identify relationship between *observed factors* and company size. Empirical research deals with factor analysis that gives up reduction of surveyed indicators. Our research has showed that there are three factor groups of financial indicators in the area of agricultural companies: operational factor, profit factor and return factor. These index groups consist of traditional financial indicators complemented of (for instance): profit per employee or average cost of employee

(the last two can be described as financial ratios). At the same time, dependence among the above mentioned factors (indices) and company size has been identified. In the first connection - between operational factor and company size - the intensity inclines to be strong. Consequently, we can say that this index is the most important from the point of dependence strength in relation to the company size. In the second connection - between profit factor and company size - the intensity inclines to be rather low and in the third connection - between return factor and company size - the intensity inclines to be low. Management of the agricultural company can compare its performance with performance of other companies in the market and can identify its weaknesses.

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Contact Address

Ing. Jana Hornungová, Ph.D.
Brno University of Technology, Faculty of Business and Management
Department of Economics
Kolejní 2906/4, 61200, Brno, Czech Republic
Email: hornungova@fbm.vutbr.cz
Phone number: +420 54114 2616

Ing. František Milichovský, Ph.D. DiS.
Brno University of Technology, Faculty of Business and Management
Department of Management
Kolejní 2906/4, 61200, Brno, Czech Republic
Email: milichovsky@fbm.vutbr.cz
Phone number: +420 54114 3757

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