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**METHODOLOGICAL ANALYSES ON THE INCOME
SITUATION OF THE AGRICULTURAL SECTOR**

Theses of the Ph.D. dissertation

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1. INTRODUCTION

1.1. Significance of the topic

The objective of economic entities is profit maximisation, the one and ultimate measure of success being financial efficiency and profitability. This is why it is essential for all kinds of economic actors to explore their income opportunities. The issue is of primary importance to the agricultural sector, as it has undergone fundamental changes since the change of regime.

Profitability analysis is of special significance from another point of view, too, as the performance of the entities in any industry affects that sector's position in the country's economy. Consequently, macroeconomic relationships must not be ignored in the analyses, as there are factors which appear to economic actors as given, which they can not influence, and which, however, have an effect on their profits.

Studies on profitability are of an inter-disciplinary nature, being related to a number of different sciences. Profitability analyses are of special importance to the fields of, among others, controlling, accounting and finances.

1.2. Research objectives

Present paper investigates various relationships with respect to profitability, both in a micro- and a macroeconomic context. Corporate analyses included corporations from industries other than agriculture, as well, mainly for comparative purposes. It was not my intention to identify all factors of profitability or to provide a comprehensive analysis of income situation. Based on the information available, I placed emphasis on relationships the examination of which necessitates the use of relatively modern methodological procedures.

My primary objectives were:

- a) When assessing the position of the industry, I analyzed the factors which, according to literature, have a negative effect on agricultural incomes, and thus on profitability. It was investigated, whether the effect of terms of trade, being one of these factors, may be considered significant. The analysis was based on empirical data on Hungarian agriculture.
- b) Also, it was my intention to identify how corporate processes might affect profitability.
- c) There is no generally accepted definition of profitability. Therefore, my primary objective was to compare the various concepts mentioned in literature. Similarly, it seems that researchers cannot reach an agreement over which indices are suitable for profitability

analysis purposes. In my point of view, one's judgement about an economic actor's activity and thus the examination of its profitability should take into account how efficiently they can use their financial assets. That is exactly the reason why my analyses were based on net profit after tax (NPAT) instead of earnings before interest and taxes (EBIT).

d) Another one of my objectives was to clarify whether the indices used in the analyses of non-agricultural businesses are suitable for use in the analyses of agricultural corporations. My assumption was that the examination of the agricultural sector might necessitate the use of indices other than the ones used for other businesses.

My most important hypotheses were as follows:

- 1) The influence of terms of trade is very difficult to quantify, thus the analysis of expenditures and the producer price index is a more significant matter.
- 2) During the analysis of macroeconomic data, autoregressive effects have to be taken into account in the interpretation of regression results, exactly because they are time series data.
- 3) Considering agricultural businesses, profitability analyses necessitate the use of indices other than those used for non-agricultural corporations.
- 4) Profitability is significantly influenced by, among others, corporate size and performance.

Having studied and interpreted the various views reflected in literature, my definition of profitability is: **an economic entity is considered profitable if its rate of return on sales (or return on costs), including extraordinary items and net financing income, is positive. Profit itself is an absolute figure, which provides information on profitability only if related to various other indicators.** The specific indicator used depends on the purpose of the analysis: asset value, total costs, total labour cost etc.

A positive profitability, however, does not necessarily mean that the business in question is actually competitive in its market. **An economic entity is competitive only if its profitability reaches or exceeds the market average.**

2. MATERIAL AND METHODS

2.1. Databases used

According to our twofold approach, two databases were used in my study.

For the purpose of analyzing the position of agriculture, I set up a database of **macroeconomic data**. The database contained data regularly published by Hungarian Central Statistical Office in its Statistical Yearbooks and Agricultural Statistical Yearbooks.

The database and thus the analysis included data which may have an influence on the macroeconomic position of the industry, from the period between 1990 and 2005. These were the following:

- gross agricultural product, Gross Agricultural Value-Added (GAVA), expenditures
- agricultural production and sales indexes (volume and value indices)
- GDP of the country
- investments (volume and value indices),
- expenditure price index (1990=100%)
- producer price index (1990=100%)
- price ratios (agricultural terms of trade were used in the analyses)
- net value-added

The other database was a **sample of 300 corporations**. In the spring of 2004, the questionnaire survey of the Competitiveness Research Program organized by the Institute of Business Economics at Corvinus University of Budapest (CUB, former BUESPA) was conducted for the third time. Having been involved in the data processing tasks of this 2004 survey, the sample database was created on the basis of that study.

This most recent survey was conducted between March and July 2004, respondents being 4 top executives from each one of the 301 corporations in the sample. Just like in previous years' surveys, respondents included one chief executive and one executive from the financial, sales and production areas each, all of whom were asked to complete a relatively long questionnaire. The chief executive's questionnaire dealt with the position, strategy and organizational structure of the company. The questionnaire for financial executives asked questions on cost management and controlling activities. The sales questionnaire enquired about market relationships and export activities, while the fourth questionnaire included questions on the logistics system and on information management practices.

When examining the factors of profitability, I focused on the variables in the financial questionnaire. This part of the questionnaire included data from the balance sheet and the

income statement. These were used to establish a number of financial indicators, the formulae of which are shown in Table 1.

As the 2004 survey asked for data from both 2000 and 2002, the database was also suitable for comparisons by time. Thus the aforementioned indicators were calculated for two years.

Table 1

Indicators used and their formulae

Name of indicator	Formula
Current ratio	$(\text{Current assets} - \text{Inventories}) / \text{Short-term liabilities}$
Liquidity ratio	$\text{Current assets} / \text{Short-term liabilities}$
Ratio of current assets	$\text{Current assets} / \text{Balance sheet total}$
Equity ratio	$(\text{Fixed assets} + \text{Inventories}) / \text{Shareholders' equity}$
Rate of indebtedness	$\text{Liabilities} / \text{Balance sheet total}$
Shareholders' equity ratio	$\text{Shareholders' equity} / \text{Balance sheet total}$
Leverage	$\text{Liabilities} / \text{Shareholders' equity}$
Return on sales	$\text{After-tax income} / \text{Net sales}$
Return on equity	$\text{After-tax income} / \text{Shareholders' equity}$
Return on assets	$\text{After-tax income} / \text{Total assets}$
Profit per headcount	$\text{After-tax income} / \text{Headcount}$

Source: own compilation

2.2. Considerations in the selection of methods

The hypotheses were tested using a variety of different methodological procedures, dependent on the nature, on the professional background of the assumption in question. The following requirements were formulated with respect to the methods to be selected:

1. The method is to be suitable for analyzing two- and multi-variable stochastic relationships.
2. The analysis of the factors by time must be feasible.
3. The method must provide a means of narrowing the set of initial variables.
4. Results shall be economically sound, and generalizable.

5. The procedure must be suitable for establishing groups, with respect to both the variables and the units of observation.

In the absence of a single method which could meet all requirements, I decided for using multiple analytical methods in my study. Taking into consideration the nature of the variables, the following methods were applied in order to meet the above requirements:

- correlations and regressions in the case of relationships between quantitative variables,
- stochastic time series analyses for identifying changes in macroeconomic data by time,
- factor analysis for narrowing the number of variables involved in the examination of the corporate sample,
- cluster analysis for creating groups in the sample by profitability.

3. RESULTS

1. The role of agricultural terms of trade

Even though the primary objective of this paper was the analysis of corporate profitability issues, the knowledge of some basic tendencies in macroeconomic processes is inevitable.

There are certain factors, economic conditions for each corporation, which cannot be changed in the short run, or which cannot be changed at all. Some conditions of the economic environment also belong to this category. Considering agriculture, terms of trade has always been the subject matter of studies; practically, all but a few researchers have paid special attention to terms of trade and its effects. Agricultural terms of trade is the quotient of the change in agricultural output prices and the change in input prices. Increases in the price of inputs tend to exceed increases in the price of agricultural products in all countries, thus terms of trade are almost predetermined to deteriorate. Worsening terms of trade imply a weakening position of agricultural producers, and similarly, improving terms of trade indicate a that they are stronger.

In recent years, as opposed to previous years' practice, agricultural terms of trade were calculated according to the requirements of EUROSTAT, that is by dividing the agricultural producer price index by the price index of agricultural inputs (KSH [2003], Villányi J. [2006]). Thus trends which are unfavorable to agriculture are indicated by a decrease in terms of trade.

1.a. A theoretical approach to agricultural terms of trade

The influence of terms of trade on profitability was examined using a model by Mária Vincze [1993]; in consistence with the model, the following simplifying assumptions were introduced:

1. A single-product relationship was investigated, where a given type of input can be used to produce only one type of output, according to a known production function.
2. When quantifying corporate profits, labour costs and the balance of subsidies and taxes were taken to be constant, thus their value was assumed to remain unchanged in the period examined. Hence agricultural profits in this model are simply defined as the difference between revenues and the value of industrial inputs employed.

Vincze concluded that changes in the value of agricultural production are most significantly influenced by terms of trade and input costs (as external factors) and changes in transformation index of industrial input (as an internal factor).

According to the findings based on the model, an increase in profitability can only be ensured if the increase in efficiency exceeds the reciprocal of the terms of trade. Considering this approach, it is indifferent whether the terms of trade improve or worsen (that is whether its value is below or above 1), the point is that the change in efficiency must be greater than this quotient.

1.b. The relationship between terms of trade and GAVA in practice

In the first stage of calculations, I looked at the figures of terms of trade and GAVA from the period between 1991 and 2005. Having compared the price index of agricultural products with the input price index (base: 1990), it was apparent that the terms of trade worsened in the period examined, thus the increase in manufactured goods' prices was greater than the increase in the producer price index.

The relationship between terms of trade and GDP was investigated using correlation and regression analysis. Terms of trade are in a close negative relationship with both GDP and GAVA.

1.c. The effect of changes in industrial and agricultural prices

Agricultural terms of trade being the quotient of the change in agricultural prices and the change in industrial products, these two price indices were the first to be investigated with respect to their influence on GAVA and agricultural expenditures. My conclusions are:

1) The coefficient of determination is larger in the case of expenditures than for GAVA. This means that the value of expenditures better correlates with these price indexes than GAVA does, that is price changes have a more direct effect on expenditures.

2) All four functions have a positive gradient, thus both GAVA and expenditures correlate with price changes. The gradient of expenditures, however, is greater than that of the regression function of GAVA, which implies that a unit change in prices induces a larger change in expenditure than in GAVA.

3) Having employed a time series regression method, the Durbin-Watson statistics were evaluated, as well, which detected the presence of positive autocorrelation in all but one case (the regression function between input price index and the value of expenditures). In the remaining three cases, no definite conclusion can be drawn with respect to autocorrelation.

1.d. The effect of price indexes on GAVA and expenditures (autoregression)

The regression parameters were reestimated¹, with the following findings:

1) The coefficient of determination is higher for expenditures than for GDP, which means that expenditures are more closely related to price changes. GDP figures may be significantly influenced by a number of other factors, as well.

2) The extent of autocorrelation is denoted by ρ , and it shows the extent to which some dependent variable is determined by the previous values of the very same variable. Considering the figures in the table, it is apparent that the value for GAVA is greater, which implies that GAVA depends on, among others, its own previous values to a much larger extent than expenditures do. The value of expenditures also depends on previous year's expenditures, but to a smaller extent. This means that GAVA is more „inert“; its value is largely determined by previous years' figures.

3) This might be the reason why the gradients are lower, that is a unit price change induces a smaller change in GDP than in expenditures.

1.e. The effect of terms of trade on agricultural output

The effect of terms of trade on gross agricultural product, GAVA and expenditures was also looked into. As the Durbin–Watson statistic detected the presence of autocorrelation in the residues (the value of the statistic was around 0.5), the relationship was estimated as an autoregressive function. The results as a function of terms of trade are shown in Table 2.

¹ The Prais-Winsten transformation was applied to autoregressive processes because, as mentioned in the Material and Methods chapter, this procedure yields more accurate results for a low number of observations.

The data in the table make it apparent that out of the three variables, expenditure is explained by terms of trade to the smallest extent. This finding is, however, rather surprising if contrasted with our former statement that expenditures are more sensitive to changes in the price indexes. One might raise the question, whether the effect of terms of trade can be evaluated directly at all, or only if we analyze the effects of producer and input price indexes separately.

Table 2

The effect of agricultural terms of trade on various agricultural indicators

Name	Gross product	Expenditures	Agricultural GDP
R^2 (%)	33.6	22.9	51.0
ρ	0.863	0-879	0.804
b	12312.819	7239.595	5.21

Source: own calculation

In order to confirm the above, I further examined the changes in GAVA as a function of changes in terms of trade. According to results, if there is a unit increase in terms of trade – which means an increase of 1 %, and a price ratio change which is (according to the new method of calculation) favourable to agriculture – then GAVA decreases by HUF 16.893 billion.

As the country's GDP and GAVA are of a different order of magnitude, the results of the power regression were also analyzed. Parameter b_1 of the power function is interpreted as elasticity, thus if terms of trade increases by 1 % then GAVA is expected to decrease by 2.87. For national GDP, this elasticity is much higher, more than double of the agricultural value. Should agricultural terms of trade increase by 1 %, national GDP is likely to decrease by 5.79 %.

The comparison of the two elasticities supports that terms of trade do indeed have an effect on GDP (and GAVA), yet their influence is much smaller on agriculture than on the economy as a whole. If agricultural terms of trade improve (that is price ratios change in favour of agriculture), GDP deteriorates. In other words, worsening agricultural terms of trade (an unfavourable change in price ratios, which is much more often the case), on the contrary, improve GDP figures; the increase is smaller in extent for agriculture, than for the entire country. The increase in GAVA caused by a change in agricultural terms of trade is smaller than the increase in national GDP, thus the percentage contribution of agriculture to the national economy is also reduced.

1.f. The GDP to gross output ratio

It was also investigated whether the GAVA to agricultural GDP ratio is directly related to changes in terms of trade. This indicator shows the percentage value of GAVA expressed in terms of gross agricultural output, thus it informs us about the income situation of the sector. The GAVA to gross agricultural product was the highest in 1994 and 1995, namely 49%. This is partly explained by the fact that the largest increase in GAVA in the period examined (32 %) was that of 1994-1995. In the 1990's, the value of this indicator was typically above 40 %, yet in the 2000's it tends to remain under 40 %.

According to the relevant function, the GAVA to gross product ratio can only be explained to a small extent by terms of trade. Considering the linear regression function, 44.9 % of the variance of this indicator is explained by agricultural terms of trade in the current period. The value of parameter b_1 of the regression function tells us that a 1 % rise in terms of trade induces a 0.56 % increase in agriculture's share in national GDP.

The function: $\hat{y} = 1.195 + 0.56x$

where x : Agricultural terms of trade 1990=100%

y : GAVA to gross output ratio (%)

Thus if one accepts that this ratio expresses the income-producing capacity of the agricultural sector, then it is unquestionable that improving price ratios positively affect this capacity. According to the power function², a 1 % increase in terms of trade will yield a 0.863 % increase in the GAVA to gross product ratio; thus the increase in our indicator of profitability is still smaller than that of terms of trade.

Conditions of the regression function

It seems that the above conclusions confirm that terms of trade have a negative effect on the position of agriculture, that is if price ratios changed in favor of agriculture (increasing terms of trade) then profitability would improve, as well. However, there are a couple of issues concerning the aforementioned functions and the compliance with the applicability criteria of regression analysis.

One of the most important questions is whether the residuals follow a normal distribution. Should this not be the case, then the tests of the parameters might be misleading us. Out of the set of small-sample methods, graphical tests might be applied instead.

Another condition is the absence of autocorrelation in the residues, which is most frequently tested using the Durbin–Watson method. The value of the DW-statistic for the function

² This has a somewhat worse fit; the coefficient of determination is 38.4 %.

describing the relationship between the GAVA to gross output ratio and terms of trade is 0,73. This is below the relevant value (for one independent variable and 15 elements in the sample) which implies the presence of positive autocorrelation.

Possible solutions for autocorrelation

The above means that we had to reconsider the model to be applied. Two potential solution options are described below.

I. One solution is to attempt to use some kind of ARMA function for the residues, which is related to time series analyses. If one takes into account that these are time series data, they might find several methods suitable for analyzing the data (in this case: the residues) among the procedures used in time series analyses.

The selection of the appropriate ARMA model might be based on the autocorrelation (ACF) and partial autocorrelation functions (PACF) of the variable in question. Our ACF resembles a „fading” sinus curve, which might indicate an AR process.

I examined the value of the Akaike information criterion in order to find the most suitable ARMA model. The residues of the regression function were identified to follow an *ARMA(1,0)* pattern.

II. The other possibility is, if the residues are potentially autocorrelated according to one of the tests, to use either the Cochrane–Orcutt or the Prais–Winsten transformation in order to estimate the parameters in an iterative way. Both transformations were performed; the results are compared in Table 3.

Table 3

Comparison of the results from the Cochrane–Orcutt and the Prais–Winsten transformations

Name	Cochrane-Orcutt	Prais–Winsten
Initial DW-statistic	0.743	0.743
Final autocorrelation coefficient (ρ)	0.573	0.570
Adjusted coefficient of determination (R_{adj}^2)	0.955	0.966
Final DW-statistic	1.796	1.798
Regression parameter	0.584	0.584
Significance of the parameter	0.000	0.000

Source: own calculation

The two transformations yielded very similar results. The adjusted coefficient of determination, according to the PW-method, is high (96,6%), which indicates that the function has a very good fit. The significance of the parameter is very good in both cases. The autoregressive process has a smaller role in the PW regression function than in CO, and the gradient of the regression parameter is higher, too. The difference, however, is very small. The PW model suggests that the regression parameter plays a greater role, thus the variable is less „inert” in this function; the GAVA to gross product ratio depends on its own previous values to a smaller degree – which is still rather high in absolute terms. In the CO model, autocorrelation is somewhat higher, thus the GAVA to gross product ratio is somewhat more influenced by its own previous values.

A very important statement concerning the function is that the current value of terms of trade is positively related to the profitability of agriculture.

The aforementioned functions did not contain the constant term; if that is included in the analysis, then agricultural terms of trade becomes a non-significant parameter, accompanied by a very low gradient!

2. Changes in natural indices

Besides terms of trade, it is the natural indices of efficiency which may have a significant effect of agricultural output and GDP. In my analysis, I considered the average crop yields of wheat and corn (the amount of crops produced per hectare in kgs) and the average pig and cattle stock per 100 hectare.

The natural indices of both farming and stock-raising have significantly changed since 1990. Farming was rather characterized by fluctuations, while stock-raising has witnessed a nearly continuous decline.

Both series of data were examined, and it was concluded that both variables have suffered a significant fall during the period examined. Subsequently, I established a regression model with GAVA being the dependent variable and the natural indices being the independent variables. In the light of the trends observed, it was not very surprising that the average crop yields of wheat and the average pig stock proved out not to be significant. The coefficient of determination for the other two variables was 80.9 %, thus the changes in GAVA can be well estimated on the basis of changes in average crop yields of corn and average cattle stock; what is more, the relevant tests showed that the residues are not autocorrelated.

The linear function that best fits the data:

$$\hat{y} = 453051.1 + 38.27 \cdot x_1 - 20784.7x_2$$

where x_1 : Average crop yields of corn (kg/ha)

x_2 : Cattle stock (pc/100ha)

y : GAVA (current prices, million HUF)

The gradient of the average crop yields of corn is positive, thus if crop yields increase, GAVA tends to increase, as well. A unit increase in average crop yields is accompanied by a HUF 38 million increase in GDP. The gradient of cattle stock being negative shows that an increase in cattle stock would not have been favourable due to the weak position of the industry, as both production and sales have suffered a heavy setback.

After all, we might draw the conclusion that both natural indices and price ratios have an influence on the macroeconomic indicators of agriculture. However, the effects of terms of trade, the aggregated index expressing changes in price ratios, are very hard to quantify directly. It is the analysis of input price indices and producer price indices which are of special significance to our subject matter.

3. The analysis of corporate profitability using factor analysis

The profitability analysis of corporations was based on the results of the questionnaire survey. First of all, factor analysis was used to examine the variables, with a dual purpose:

- 1) Considering the everyday operation of a company, all indicators are important, as each one of them provides a picture of some „slice” of the organization. Nevertheless, I assumed that the information content of profitability indices can be concentrated in a single artificial variable, which is then able to inform us on the profitability of the business in general.
- 2) Second, it was an important purpose to identify the factors to be considered in later analyses.

3.a. The variables included in the analysis considering the total sample

In my analyses, I used standardized variables (that is: expected value is zero, standard deviation is one), as the differences in the units and the orders of magnitude between the original variables would have influenced factor loadings, and thus the formation of the factor structure; all of these problems could be avoided by using standardized variables.

From among the 11 indicators, all of which are based on various balance sheet and income statement items, the following four are the ones which provide information on corporate profitability:

- return on assets,
- profit per headcount,
- return on equity and
- return on sales.³

Prior to actually performing the analyses, I assumed that these four profitability indices will be separated from the others, which I wanted to prove empirically. Furthermore, I assumed that the information content of these variables can be expressed by a single variable. Without rotating the factor structure, the analysis did not yield a simple structure, therefore I decided to apply varimax rotation.

The results for the total sample being almost completely identical for the two years in question, we can conclude the following:

1. The information content of all 11 financial indicators could be concentrated into 4 factors, the second of which is the factor of profitability. Consistent with our preliminary assumptions, the indices used for profitability analysis purposes did indeed separate from the others.
2. The factors represent so-called latent, background variables. If we accept that the second factor expresses profitability, then it can be concluded that profitability is most clearly reflected in the company's return on assets. Even though the content of this variable is not identical with that of profitability, it is still the most suitable, out of the examined indicators, for expressing profitability in general. Return on equity, on the contrary, is the least appropriate indicator for judging a company's profitability.
3. The ratio of current assets constitutes an individual factor, which means that, with respect to the total sample, this variable cannot be related to either one of the factors expressing liquidity, profitability and capital.

3.b. Indicators of profitability considering agricultural businesses

The very same analyses were conducted for agricultural corporations, too. I examined whether there are changes in the factor structure or the relationships between the variables rather remain constant. The aforementioned set of 11 financial indicators was examined, for both years, yielding the following conclusions:

³ My analysis did not exclusively include profitability indices in their narrow sense, one of the reasons for which was that some researchers argued that liquidity indices can be used for the purposes of profit analysis, as well.

1. The information content of the financial indicators can be concentrated in 3 factors, the first of which is the one expressing profitability. The indices used for profitability analysis purposes did separate from the others.
2. Besides the four indicators mentioned above, the profitability factor also included shareholders' equity ratio, even though its loading was low. This implies that shareholders' equity ratio is in a negative relationship with the profitability of agricultural businesses.
3. With respect to agricultural enterprises, profitability is most clearly reflected in return on equity and return on assets. Our above statement that return on assets is the most suitable for expressing profitability in general holds true for the agricultural sector, too. Return on equity, however, is more important than it was in the case of the total sample. This is a consequence of the special, unique characteristics of the factor of production employed (namely: land).
4. Profit per headcount is the least important variable from amongst those in the profitability factor. This is not very surprising, this indicator was typically not referred to in literature, either. Seasonal employment is widely characteristic for agriculture, which is the reason why labour input is measured in labour units per year. This latter is typically used for profitability analysis purposes, as well.
5. As opposed to the total sample, the ratio of current assets does not constitute an individual factor; it is closely related to the factor expressing capital.

4. Classifying corporations by the variables influencing their profitability

In the process of research, the idea emerged that it would be useful to formulate, to identify some corporate characteristics on which further research into the specifics of certain groups of companies can be built, and which might be used by all researchers according to a single (given) interpretation. Businesses were classified by 10 variables:⁴ corporate size, type of ownership, main activity (sector), diversity of activities, export-orientedness, expectations concerning the EU-accession, relationship to changes in the market/environment, corporate performance, market objectives and market characteristics (market concentration).

4.a. Analyzing corporate size

Two years' data being available, some comparisons were done in order to identify how the value of the various indicators changed by corporate size. The results are presented in Table 4.

⁴ For details on the classification process see: Wimmer- Csesznák [2005]. Here, I only mentioned the details which are of importance to my later analyses.

Table 4*Profitability by corporate size*

Corporate size	Return on sales		Change 2000=100%	p-value of the paired T-test
	2000	2002		
Small	0.0727	0.0128	17.6	3.9%
Medium	0.0295	0.0291	98.6	94.3%
Large	0.0206	0.0312	151.5	6.3%
Altogether	0.0372	0.0258	69.4	

Source: own calculations

Considering changes, it is obvious that only large corporations could increase their return on sales, by approximately fifty percent in two years' time. Though the profitability of medium companies deteriorated as compared to the average change, the decrease was certainly not one of a very large extent. Small businesses, however, have suffered a dramatic fall. Consequently, one might raise the question whether the real significance of corporate size is expressed in the form of profitability as compared to the other groups. Future opportunities are of extraordinary importance to any corporation. Therefore, what corporate size actually determines are the opportunities for future changes in profitability.

The paired T-test detected a significant difference only in the case of small companies, thus it was clearly confirmed that the return on sales of small corporations decreased significantly during the period examined.

4.b. Expectations concerning the EU-accession

In the case of companies' expectations concerning the EU-accession, classification was done by cluster analysis, yielding three groups altogether.

1. **Optimists** (137 companies): corporations which see opportunities, basically hope for market expansion, nevertheless expect stronger competitors, as well.
2. **Neutrals** (61 companies): do not expect any significant changes in the market following the accession, indifferent to the process, not very optimistic, but not worried, either.
3. **Sensing uncertainties** (66 companies): they expect a more fierce competition, they see risks and uncertainties caused by the EU-accession.

Considering the changes in profitability indicators, some significant differences can be observed in the case of optimists. Return on equity (p-value 7.4%) and return on assets (1.4%) significantly changed from 2000 to 2002. The direction of the change, however, is rather

surprising: their profitability decreased significantly in the period examined⁵. Return on sales also decreased (by 47%), along with the factor value of profitability, yet these were not found to be significant. Thus the group of optimists included those corporations the profitability indicators of which were above the average in 2000, which have, however, significantly fallen by 2002. Most probably, they hoped for even better opportunities and profitability as a consequence of the country's EU-accession.

In the group of neutrals, the differences in the changes were not significant, and neither were those in the values themselves; their profitability indices have hardly changed in those two years.

The profitability indicators of those sensing uncertainties deteriorated, as well, and the average profit per headcount turned out to be negative, too. However, these changes could not be statistically validated.

4.c. Relationship to changes

The relationship to changes, the ability to react was studied on the basis of top managers' self evaluation of their companies' reactions to changes in the environment. Companies with a late reaction and companies who recognized the changes but did not react in a timely manner were treated as a single category: the group of those having difficulties tracking the changes. Those providing any other answer were classified into separate groups.

The changes in profitability indices demonstrate significant differences. For those having difficulties tracking the changes, all profitability indicators worsened significantly in the period examined, accompanied by a similar fall in the factor value.

Profit per headcount, however, significantly improved (p-value 6%) for those influencing the changes themselves; its value rose to more than the double of the previous figure. In this group, profitability improved, which was also reflected in a significant increase in the factor value.

4.d. Corporate performance

The basis for the classification by corporate performance was the self-evaluation of top managers, as well. The cluster analysis of their responses resulted in three well-distinguishable groups with different levels of performance. Respondents told us about their return on sales, return on equity, market share, technological and managerial level and the quality of their products or services. *By their self-evaluation of performance as compared to industry standards* businesses might be classified into three groups (laggards, average performers, leaders).

⁵ Return on equity fell by 80 percent, return on assets by 40 percent.

Considering the relationship between the self-evaluation of corporate performance and profitability, a significant change is to be observed in the case of laggards.

Each one of the profitability indices of laggards fell by 2002. Three of these changes are considered significant:⁶

- return on sales (1.3%),
- return on equity (4.3%)
- return on assets (3.4%).

Thus there is a close relationship between the evaluation of corporate performance and the changes in profitability indicators.

Average performers did not demonstrate any significant change or trend. Some indices improved (return on equity), some deteriorated (return on sales, profit per headcount), and there were some which did not even change.

All profitability indices of leaders, except for return on equity, improved; the change in profit by headcount, with a p-value of 5.4%, might even be considered significant. Thus a relationship exists between the self-evaluation of performance and profitability indices in the group of leaders, as well.

4.e. Market concentration

Market concentration was characterized by the number of companies the market shares of which add up to 75 %.

According to the responses provided, the majority of companies operates in markets where 75 % of total market turnover is realized by at most 4 companies. The profitability of companies operating in concentrated markets increased during the period examined, with respect to all profitability indices and the factor value, as well. Two of these changes are considered significant. The p-value for profit by headcount is 7.4%; that of the profitability factor is 3.9%. In the remaining two groups, profitability deteriorated, with respect to all indicators. Thus it might be concluded that corporations operating in concentrated markets improved their profitability between 2000 and 2002.

Previous studies typically found a positive relationship between market concentration and profitability, except for Austria, where the relationship proved out to be negative (Aiginger and Leo [1991]). Considering our corporate sample, neither one of the two statements can be confirmed. The „direction” of the relationship between profitability and market concentration cannot be unambiguously determined. Businesses operating in concentrated markets did have a chance to improve their profitability, thus market concentration has a positive effect on these indices.

⁶ P-values are shown in parantheses.

Considering those operating in moderately concentrated or dispersed markets, we cannot draw such general conclusions. Consequently, the relationship between market concentration and profitability calls for further research and analysis.

5. Analyzing the variables influencing the profitability of agricultural businesses

Above, it was presented how a couple of variables affect changes in corporate profitability. Now, we are going to look at how agricultural corporations are affected, and we will underline some major differences, as well. The sample included 26 agricultural companies, the majority of which (42.3 %) were medium size companies.

With respect to the expectations concerning the EU-accession, the distribution of agricultural corporations differs from that of the sample as a whole.

Table 5

Distribution of companies in the sample by expectations vs. that of agricultural businesses

Name	Total sample	Agricultural businesses
	Distribution (%)	
Optimists	51.9	62.5
Neutrals	23.1	12.5
Sensing uncertainties	25.0	25.0
Total	100.0	100.0

Source: own calculations

A relatively large difference is to be observed among optimists, where a much larger proportion of agricultural corporations had positive expectations of the EU-accession.

Considering the relationship to changes, a similar statement might be formulated, as the ratio of those influencing the changes themselves and those preparing for them is much smaller than in the total sample.

As a summary, we might conclude that among agricultural companies (as compared to the total sample), there was a much larger proportion of small companies who were optimistic about the EU-accession. Those operating in the agricultural sector tend not to recognize changes in a timely manner, they themselves tend to consider their own companies to be average performers. All of these factors, as formulated in the observation above, are negatively related to corporate profitability. Accordingly, a decrease in profitability, except

for one index, could indeed be observed in this group. Thus we can conclude that our former statements hold true for agricultural businesses, as well, that is:

- corporate size,
- expectations concerning the EU-accession,
- relationship to changes and
- evaluation of corporate performance

have a significant influence on corporate profitability.

6. Clusters in the sample by the variables influencing corporate profitability

Using cluster analysis, the corporations in the sample might be classified by the previously analyzed variables (size, expectations, relationship to changes, performance and market concentration). There were four groups, altogether including 193 companies from the sample. Table 6 shows the distributions by cluster.

Table 6

Distribution of corporations by cluster

Cluster	Number of companies	Distribution of companies %
1	47	24.4%
2	56	29.0%
3	55	28.5%
4	35	18.1%
Altogether	193	100.0%

Source: own calculations

The clusters might be characterized by the very same variables as the ones used to create the clusters; this characterization is presented in Table 7.

Table 7*Characteristics of the clusters*

Cluster	1.	2.	3.	4.
Size	Small company (large company)	Medium	Medium-Large	Large company
EU-accession	Neutral (difficulties)	Non-neutral	Difficulties (neutral)	Neutral (optimistic)
Changes	Late reaction (prepare)	Late preparation	Late reaction (diff. i. tracking)	Influence (prepare)
Performance	Average	Average (leader)	Laggard	Leader
Concentration	Moderately concentrated	Dispersed market	Moderately concentrated	Concentrated market
Name	Doubtful	Stagnant	Laggard	Prosperous

Source: own analyses

The first cluster was named *doubtful* because even though they consider themselves to be average performers, they do not react to changes in a timely manner. Typically, they are small corporations, which are rather neutral or which expect difficulties with respect to the EU-accession. The future of the company might very well depend on whether they are able to improve their flexibility in the future.

The members of the next cluster are in a somewhat better situation, which are of a medium size but their performance is above the average. These companies typically operate in dispersed markets; we will call them *stagnants*, as they are the ones who represent the average – in any aspect.

Worst is the situation of the third cluster, the members of which are large or medium companies who have difficulties tracking the changes and do not react in a timely manner, being below-average performers even according to their own evaluation. They tend to sense difficulties concerning the EU-accession, as well. They are called *laggards*.

The fourth cluster consists of *prosperous*, well-performing companies, typically large corporations which generate market changes themselves, operate in concentrated markets and consider themselves to be leaders.

Having established the groups, I looked into the changes in profitability ratios in each cluster during the two years examined. Analyses were completed using the differences between the corresponding values, as they indicate the direction of change more obviously than ratios do.⁷

The decrease in profitability indices, except for profit by headcount, was the most dramatic in the case of laggards. The group of doubtfuls, however, also suffered a heavy setback in profitability during the period examined.

The profitability of stagnants decreased by a minimal extent, their profit per headcount even increased somewhat.

Profitability indices also supported the idea that the best results tend to be achieved by prosperous companies. Each one of the profitability indicators examined demonstrated an improvement in this very group, profit by headcount having risen to a particularly significant extent (by HUF 1098.09 thousand).

Therefore the general conclusion can be drawn that these variables did indeed have a significant impact on profitability in the period examined

⁷ If the value of some profitability index would have been negative in both years, their quotient would be positive. The difference of them, however, indicates whether the profitability of the company in question has improved or not.

4. CONCLUSIONS AND RECOMMENDATIONS

In my present paper, I attempted to test my hypotheses on changes in profitability using modern statistical methods. There were two approaches to these analyses: a macroeconomic and a microeconomic point of view.

The macroeconomic analyses included the examination of time series data of the profitability of the agricultural sector, with special emphasis on terms of trade, one of the most important factors of profitability in agriculture. Based on the results of correlation and regression analyses, I concluded that a worsening terms of trade alone does not have an influence on how agricultural output changes with time. The primary reason for this is that the effect of the two price indices are eliminated in this aggregated indicator. This is also confirmed by the data in the correlation matrix. Considering terms of trade, latency did not prove out to be significant, either, the individual price indices, however, are significantly related to both agricultural and national output figures. As a consequence, it makes much more sense to treat the changes in agricultural prices and the fluctuations in input costs separately. Another consequence is that the long term effects of price ratios can only be observed if the two price indices incorporated in terms of trade are examined separately.

Another conclusion related to time series data is that a significant portion of the economic data examined actually reflect autoregressive processes. It was demonstrated that expenditures depend on their own previous values to a smaller extent than GDP and GAVA do. This means that GDP (and GAVA) represent very „inert” processes, thus their values do not change significantly on a year-by-year basis. Expenditures are far less „inert”, that is their reactions to changes in prices were much more flexible. Consequently, forecasts need to take into account previous years’ figures, as well, especially in the case of GDP and GAVA.

An important point to be made is that future studies should by all means take into consideration the results of autocorrelation tests when performing regression analyses, because, as evidenced by my calculations, the absence of these might lead to erroneous conclusions.

For similar reasons, a thorough knowledge and understanding of stochastic time series analysis methods is essential. Considering deterministic time series analyses, the requirement of a long term trend is very often not met in practice. Forecasting the reactions of agricultural corporations and the estimation of output figures constitute a special problem and task for future studies.

My microeconomic analyses yielded the conclusion that the profitability analysis of agricultural corporations cannot be based on exactly the same indicators as the analysis of non-agricultural companies. For the purposes of comparing companies operating in different sectors (thus having a different liability structure), return on assets and return on sales are the two most suitable indices. These two indicators are most frequently referred to in literature, as well. Considering agricultural businesses, return on equity is of special importance.

Based on the corporate database and using various statistical tests, I concluded that changes in profitability are related to corporate size. The profitability of small enterprises decreased significantly, while that of large corporations increased. Noteworthy is, however, that this does not mean that there is a negative relationship between corporate size and profitability. First, it was not profitability itself but its changes which I examined; second, no statistically significant conclusion could be drawn for medium-size companies. According to my analyses, corporate size does not influence profitability itself but rather changes in profitability, the opportunities and the background factors of such increases and decreases.

Changes in profitability were also influenced by companies' expectations with respect to the EU-accession. An important finding was that optimists' profitability decreased during the period examined. The decrease in return on assets and return on equity is largely explained by the increases in their bases (asset and equity values). From the above two statements, the conclusion can be drawn that the companies in this group increased the value of their assets, their equity to a significant extent, which was, however, not accompanied by a similar increase in profits. These are companies which expected the EU-accession to ensure higher profits and a higher (thus faster) return on equity.

An important „skill” of companies is their ability to react, their relationship to changes. We found that the only corporations which could improve their profitability were those who influenced, generated the changes themselves. Those who did not react to changes in a timely manner, were faced with a rather difficult situation.

In the questionnaire, companies were asked to evaluate their own performance, as well. A consequence of my related findings (there is a close relationship between corporate performance and the changes in profitability) is the conclusion that managers' evaluation of their companies' performance proved out to be rather accurate. This is obviously an important consideration in evaluating the accuracy of the responses provided in a questionnaire.

According to my findings, the analysis of the relationship between market concentration and profitability might be of special significance. The direction of the relationship not being unambiguous, the issue must by all means be subject to further analyses.

5. NEW RESEARCH FINDINGS

My analyses yielded the following new findings:

1. I performed a thorough review of Hungarian and international literature on the topic. The most frequently used indicators were compared, and hence a set of indicators was established which can be used in scientific analyses of corporate profitability. It was demonstrated that the majority of time series data on agricultural output and GAVA are to be treated as autoregressive processes. In Hungarian literature on agricultural economics, this was the first time that the Prais-Winsten transformation, suitable for identifying major trends and relationships in short time series, was used.

2. Changes in agricultural terms of trade during the last 15 years were reviewed; and the influence of terms of trade on agricultural output was also examined. I showed that a negative effect of terms of trade on the GAVA to gross product ratio cannot be directly detected. Moreover, evidence was provided that in order to identify basic underlying relationships, special attention must be given to the one-by-one analysis of the price indices in the quotient of terms of trade.

3. Based on a questionnaire survey and utilizing modern mathematical-statistical methods, the assumption was confirmed that return on equity plays a much more important role in the profitability analysis of agricultural corporations than in the case of non-agricultural businesses. Factor analysis showed that a significant portion of the information content of the variables examined can be concentrated into factors. A factor expressing profitability was present in all cases, which, consistent with our expectations, contained the four profitability indicators. Return on assets and return on equity are the two indicators which are most suitable for expressing profitability in general. Considering the profitability of agricultural corporations, however, return on equity plays a more important role than in the total sample, while the significance of profit by headcount is lower.

4. Using statistical tests and cluster analysis, I showed that the changes in profitability in certain groups of corporations during the period examined were influenced by the following variables (at a level of confidence of 95%):

- corporate size,
- relationship to changes,
- corporate performance,
- expectations concerning the country's accession to the European Union,
- market concentration,

therefore, the impact of these factors must not be neglected by any corporate executive when making the necessary strategic decisions.

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37. sz. műhelytanulmány (p. 33)

18) Bácsi Katalin – Szótsné Kovács Klaudia – Takács Sándor – Toárniczky Andrea: Emberi erőforrás menedzsment, leadership és versenyképesség

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39. sz. műhelytanulmány (p. 25, 41)

19) Balaton Károly (szerkesztő): Vállalati stratégiák az EU-csatlakozás időszakában

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20) Demeter Krisztina és Matyusz Zsolt: Értékteremtés funkcionális alapokon

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21) Kolos Krisztina (szerk.): Vállalatközi kapcsolatok és a versenyképesség összefüggései

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22) Wimmer Ágnes – Zoltayné Paprika Zita (szerkesztők): A vezetés és a döntéshozatal szerepének elemzése az üzleti szféra viszonylatában

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23) Wimmer Ágnes – Szántó Richárd: Teljesítménymenedzsment és értékteremtés az érintettekkel való kapcsolatok kezelése tükrében - 2006

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