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# The Analysis of the Indebtedness of Slovak Agricultural Enterprises in Years 2003 and 2009 and Multi-criteria Analysis of Slovak Agricultural Enterprises in Years 2003 and 2009

*This article shows the changes of structural census of agricultural enterprises which was lastly performed in 2010. The census of agriculture is published every ten years. The aim of the article is to show the impact of farm's legal forms on sources of funding which is one of two main objectives of article's research. Second objective explains the correlation of legal status of enterprises and sources of external funds. From the comparison of these two points, the result will either confirm or refute the claims that farms should have the highest contribution of external capital to achieve the ideal results.*

## Introduction

The entry of Slovakia to the EU had a considerable impact on whole Slovak economy, especially on agriculture which was the basis of integration in the EU. Slovak agricultural policy was in fact replaced by a CAP. The changes in Slovak agriculture were necessary for the integration. The acceptance of the CAP brought many advantages, for example increasing of productivity, bigger production, food security, open market etc. Another important advantage was that the payments were provided to farmers what changed the form of financing. But on the other hand, some payments were not provided to the real farmers but to those who had the soil only in lease, for example**.**

Low use of the external capital in enterprises is probably caused by the high rates of the bank loans or other financial grand-in-aids. According to the well-known assumption, in the optimal functioning enterprise, the external sources should be higher than internal. (1)

This article wants to highlight the impact of the percentage indebtedness in proportion to the legal form of agricultural enterprises.

## Methods and Resources

For the analysis we used individual data on a sample of agricultural enterprises from the official database of the Slovak Research Institute of Agricultural and Food Economics in 2003-2009. The year 2003 was chosen because it was the last year when the Slovak republic used its own agricultural politics before its entrance to the EU. The year 2009 was the most appropriate year because the results were nearest to the possibilities of the database.

In year 2003 the number of enterprises was 1334 and in 2009 it was 1268. In these years, data such as negative obligations, negative share capital and mistakes in balance sheet were removed from the database**.** This way, the database was purged from unacceptable data. Values are expressed in thousands of Euros.

After sorting the data of examined enterprises in the 2003 there were 1127 enterprises and in the year 2009 it was 611 enterprises. The high difference between these two years was probably caused by mistakes in the balance sheet or in data that are voluntarily filled in the database by the enterprises. Data were analyzed by the software STATGRAPHICS. In the first part of the results we have used an analysis based on the observation of the obtained data.

In second part of results, two groups of Slovak agricultural enterprises were compared, the cooperatives and the commercial companies. For comparison in 2003 and 2009 were used various statistics and graphical representation, namely Histogram and Box Plot.

In the third part of the results Cluster Analysis was carried out for the sample of Slovak agricultural enterprises separately for 2003 and 2009. To examine the differences between agricultural holdings it is often not enough to pay attention to a single indicator and it is desirable to examine the enterprises according to several indicators simultaneously. To achieve the multicriterial analysis, the Cluster Analysis was used in this paper.

The enterprises were examined according to four indicators simultaneously, namely: percentage of external funds, area per hectare, number of employees and profit.

Cluster analysis groups objects $X_i(i = 1,2, \dots ,n)$ into clusters $C1, C2, \dots , Cq$ $(2 \leq q \leq n)$, so that objects belonging to the same cluster are close, similar and objects belonging to different clusters are distant, different. (4)

Cluster analysis was carried out separately for the years 2003 and for 2009. Clustering method used in the paper was Ward's and distance metric was Squared Euclidean.

## Results and discussion

The EU gives more than 45 % of its budget to the agriculture, and therefore EU needs absolutely correct data for creation an agriculture information system. Of course, the statistics is the base. Almost all of the statistic data necessary for agriculture are gained by Statistical Office of the SR through the structural census of agriculture. Structural census of agriculture is performed every ten years. The last one was carried out in 2010, which means that the first census of agriculture was performed in Slovakia in year 2001.

In the following Table 1 we can observe the legal forms of agriculture enterprises in the Slovak republic.

The change can be seen especially in co-operative farms which decreased in almost 19%. We can also see an increase of Commercial Companies. More than 55% increase was recognized by Ltd´s. Nearly 27% increase was recognized by Inc.´s. This disproportionate increase in both forms of companies can be a result of advantages or disadvantages of the legal form of the enterprises. It can also depend on creation of the form of these companies.

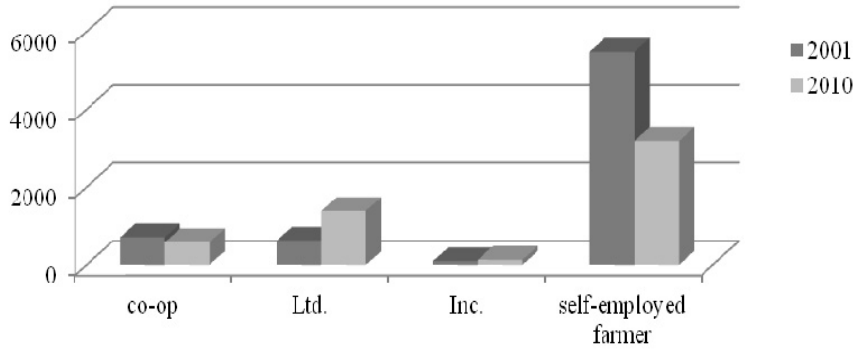
***Table 1:*** *Structure of agricultural enterprises in Slovakia (2001-2010)*

| | number of farms | | agricultural land in thousand ha | | share of total agricultural land | |
|---|---|---|---|---|---|---|
| | ***2001*** | ***2010*** | ***2001*** | ***2010*** | ***2001*** | ***2010*** |
| **Co-op** | 715 | 584 | 1131 | 740 | 47,0 % | 40,3 % |
| **Commercial Company** | 721 | 1514 | 723 | 773 | 30,1 % | 42,1 % |
| **Ltd.** | 627 | 1386 | 550 | 633 | 22,9 % | 34,4 % |
| **Inc.** | 94 | 128 | 173 | 140 | 7,2 % | 7,6 % |
| **Total number of co-op a Commercial Companies** | 1436 | 2098 | 1854 | 1513 | 77,1 % | 82,3 % |
| **Self-employed farmer** | 5473 | 3183 | 215 | 149 | 8,9 % | 8,1 % |
| **Other land** | | | 335 | 176 | 13,9 % | 9,6 % |
| **Total** | **6909** | **5281** | **2404** | **1838** | **100 %** | **100%** |

*Source*: Structural census of farms in SR 2001-2010 (3)

According to the observation we can see that the agriculture land, which is divided to the companies, has a decreasing tendency because of the increasing number of all companies which are making business in agriculture on all agricultural land in Slovakia. The increase of agriculture land was only observed by Ltd.´s.

***Figure 1:*** *Graphical representation of forms of enterprises in agriculture according to structural census of farms*




*Source*: Own processing.

A better illustration of the legal form is shown in the Figure 1. It is significant that in this picture the largest fraction data refers to the self-employed farmers. They are also called natural persons. As it can be seen in the Table 1, each of them owns only a small part of the agricultural land.

According to Tóth, Čierna and Rábek (2010) since Slovakia joined the EU the amount of external sources has risen and it is still rising. But the authors still not see

a positive respond in profitability in agriculture enterprises as they would expect. It gives a further impulse to follow an answer of a question if an increasing ratio of external capital affects the enterprise profit in a negative way in Slovakia.

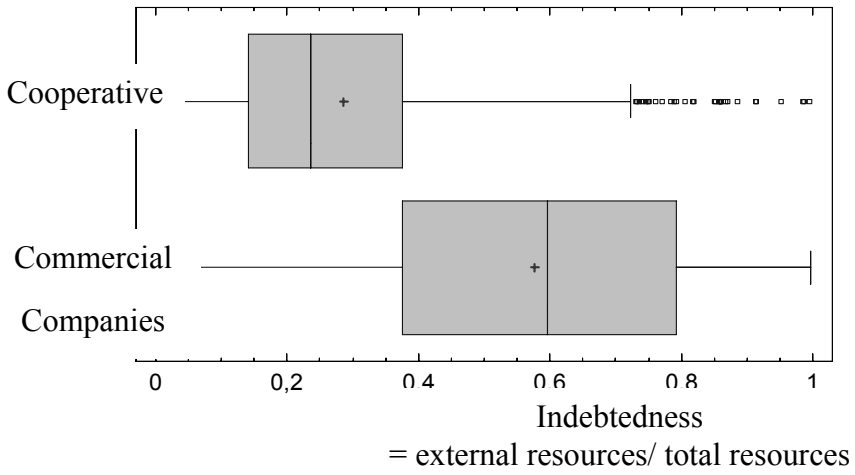
In the second part of the results agricultural enterprises were analyzed according to their indebtedness computed as a ratio between external and total resources. The analysis was carried out for 2003 and 2009. In 2003 the sample consisted of 1128 agricultural enterprises of which 587 were cooperatives and 541 commercial companies. The result of comparison of two mentioned groups of agricultural enterprises in 2003 is presented in Table 2and Figure 2.

***Table 2:*** *Summary Statistics for indebtedness of two groups of Slovak Agricultural enterprises in 2003*

| | *Cooperatives* | *Commercial companies* |
|---|---|---|
| Count | 587 | 541 |
| Average | 0,286458 | 0,577163 |
| Standard deviation | 0,198482 | 0,260498 |
| Coeff. of variation | 69,2882% | 45,1343% |
| Minimum | 0,00864731 | 0,0124913 |
| Maximum | 0,995456 | 0,996672 |
| Range | 0,986809 | 0,984181 |
| Stnd. skewness | 12,5145 | -2,66937 |
| Stnd. kurtosis | 6,71577 | -4,48369 |

*Source*: Own calculations in STATGRAPHICS

***Figure 2:*** *Box and Whisker Plot for Two Groups of Slovak Agricultural Enterprises in 2003 according to Indebtedness*




*Source:* own calculations in STATGRAPHICS

The figure shows significant difference in the average level of indebtedness of two compared groups of agricultural companies. The average indebtedness in the group of cooperatives was 28,65% (shown as red cross in the figure), in the group of commercial companies the average indebtedness was 57,72%. It is confirmed, that commercial companies have higher proportion of external resources on total resources compared to cooperatives.

The difference between median (shown as vertical line) is even bigger than the difference between averages of the indebtedness of two compared samples. Median is a numerical value separating the higher half of a sample from the lower half. In the group of cooperatives median is lower than average (mean), what indicates that the distribution of data is skewed to the right. Average of indebtedness of cooperatives is 28,65%, but more than a half of observed cooperatives had lower indebtedness than the average.

In the group of commercial companies median is higher than average (mean), what indicates that the distribution of data is skewed to the left. Average of indebtedness of commercial companies is 57,72%, but more than a half of observed commercial companies had higher indebtedness than the average.

The body of the boxplot consists of a "box", which goes from the first quartile (Q1) to the third quartile (Q3). The middle half of a data set is also called the interquartile range (IQR) and is represented by the width of the box. In 2003 the IQR of commercial companies is wider than the IQR of cooperatives. The middle half of the data (excluding 25% highest observations and 25% lowest information) has higher variability in the case of commercial companies.

In 2003 there are outliers in the group of cooperatives, represented by dots. If more than one outlier had the same indebtedness, dots are placed side by side. Dots represent those enterprises, which had indebtedness a lot more than normal or a lot less than normal.

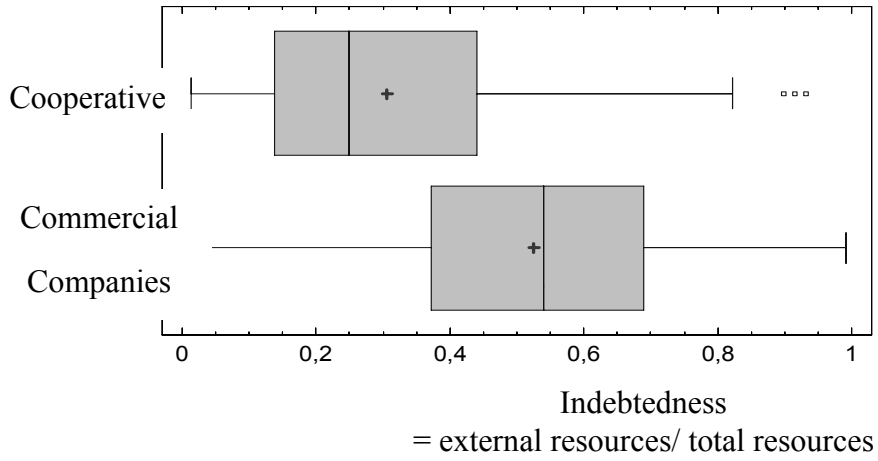
In 2009 the sample consisted of 611 agricultural enterprises of which 196 were cooperatives and 415 commercial companies. The result of comparison of two mentioned groups of agricultural enterprises in 2003 is presented in Table 3 and Figure 3.

***Table 3:*** *Summary Statistics for Indebtedness of Two Groups of Slovak Agricultural Enterprises in 2009*

| | *Cooperatives* | Commercial companies |
|---|---|---|
| Count | 196 | 415 |
| Average | 0,305265 | 0,524331 |
| Standard deviation | 0,207203 | 0,237199 |
| Coeff. of variation | 67,8764% | 45,2385% |
| Minimum | 0,0131226 | 0,006461 |
| Maximum | 0,932261 | 0,990824 |
| Range | 0,919138 | 0,984363 |
| Stnd. skewness | 5,02095 | -1,66946 |
| Stnd. kurtosis | 0,269187 | -2,52414 |

*Source*: own calculations in STATGRAPHICS

***Figure 3:*** *Box and Whisker Plot for Two Groups of Slovak Agricultural Enterprises in 2009*




*Source:* own calculations in STATGRAPHICS

The figure shows significant difference in the average level of indebtedness of two compared groups of agricultural companies. The average indebtedness in the group of cooperatives was 30, 53%, in the group of commercial companies, the average indebtedness was 52,43%. It is confirmed again, that commercial companies have higher proportion of external resources on total resources compared to cooperatives.

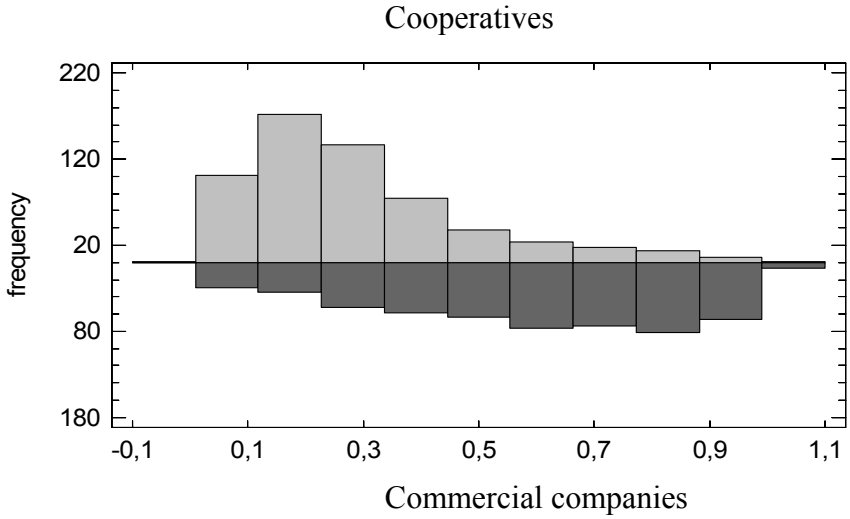
The indebtedness of cooperatives is again skewed to the right and the indebtedness of commercial companies is skewed to the left. The number of in the group of cooperatives, represented by dots is less frequent.

According to comparison the two figures (Figure 2 and Figure 3), it occurs that the distance between the averages of indebtedness of two groups of enterprises is shorter. Average indebtedness of cooperatives has risen (from 28,65% in 2003 to 30,53% in 2009), while the average indebtedness of commercial companies has fallen (from 57,72% in 2003 to 52,24% in 2009). The variability of middle 50% of observations has expanded in 2009 compared to 2003 the case of cooperatives and reduced in 2009 compared to 2003 in the case of commercial companies.

Comparison of figures y and z shows interesting finding. The distribution of cooperatives according to indebtedness did not change significantly in 2009 compared to 2003. The most frequent values of indebtedness in 2003 and 2009 are situated close to 0,1 (10%) and 0,2 (20%). Higher indebtedness than 0,5 is not so common in both observed years.

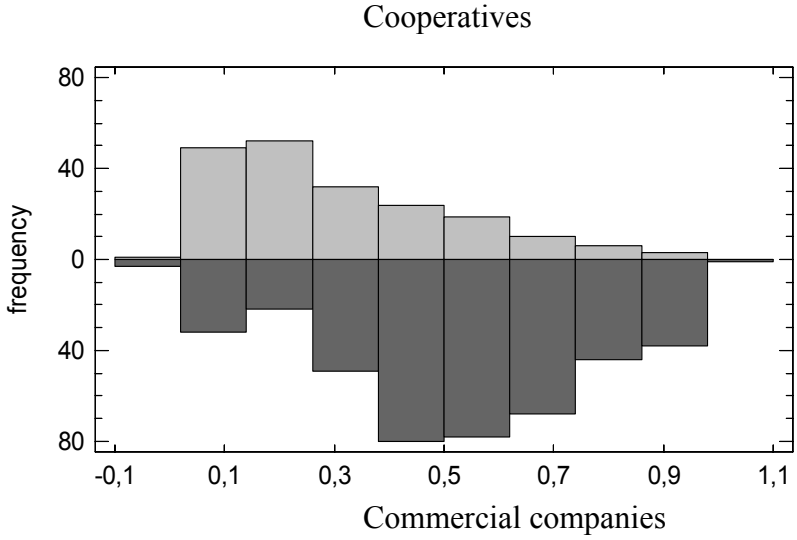
The situation for commercial companies did change over 2003 to 2009. In 2003 the frequencies are quite balanced (equal). But in 2009 we can observe that the most frequent indebtedness of commercial companies is between 40 to 70%. Therefore it may be concluded that after the admission of Slovakia to the EU, the structure of resources of Slovak agricultural commercial enterprises significantly changed.

***Figure 4:*** Histogram of the indebtedness for two groups of Slovak Agricultural companies in 2003




Source: own calculations in STATGRAPHICS

***Figure 5:*** Histogram of the indebtedness for two groups of Slovak Agricultural companies in 2009




Source: Own calculations in STATGRAPHICS

From the two figures (Figure 4, Figure 5) it may be concluded that both distributions (2003, 2009) of enterprises according to their indebtedness do not have

normal distribution, what is also confirmed by standardized skewness and standardized kurtosis (see Table 2 and Table 3), which can be used to determine whether the samples come from normal distributions. If values of standardized skewness and standardized kurtosis are inside the rage of -2 to +2, the normal distribution is conformed. If not significant departures from normality are indicated and consequently the tests which compare the standard deviations would tend to be invalidate.

In 2003 both samples (cooperatives and commercial companies) have standardized skewness values and standardized kurtosis values outside the normal range, see Table 2. In 2009 cooperatives have a standardized skewness value outside the normal range (5,02, see Table 3) and commercial companies have standardized kurtosis value outside the normal range (-2,53, see Table 3). Due to the fact that the data about indebtedness did not have normal distribution we did not compute the

Other tabular options within this analysis can be used to test whether differences between the statistics from the two samples are statistically significant.
Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the samples come from normal distributions. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate the tests which compare the standard deviations.

In the last part of results Cluster Analysis was carried out for slovak agricultural enterprises for year 2003 and 2009. The enterprises were examined according to four indicators simultaneously, namely: percentage of external funds, area per hectare, number of employees and profit.

In 2003 the sample consisted of 1122 companies (cooperatives and commercial companies). Clustering method used was Ward's and distance metric was Squared Euclidean.

***Table 4:*** *Cluster Summary of Selected Slovak Agricultural enterprises in 2003*

| *Cluster* | *Members* | *Percentage* | *Cumulative percentage* |
|---|---|---|---|
| 1 | 312 | 27,81 | 27,81 |
| 2 | 741 | 66,04 | 93,85 |
| 3 | 69 | 6,15 | 100,00 |

Source: own calculations in STATGRAPHICS and Excel

The enterprises were divided into three clusters. In first cluster were 312 enterprises, which represented 27,81% from total number of examined (investigated) enterprises. In second cluster were 741 enterprises (66,04% of total number of examined enterprises) and in third cluster 69 enterprises, which represented only 6,15 % out of total. The clusters are groups of observations with similar characteristics, in Table 5 may be observed the characteristics of three clusters according to four indicators mentioned above.

***Table 5:*** *Cluster Analysis- Centroids of Selected Slovak Agricultural enterprises in 2003*

| *Cluster* | *Percentage of external funds* | *Area per hectare* | *Number of employees* | *Profit* |
|---|---|---|---|---|
| 1 | **0,7652** | 754,78 | 18,62 | -2,80 |
| 2 | 0,2871 | 1507,48 | 54,31 | -47,82 |
| 3 | 0,3505 | **4153,34** | **203,87** | -533,53 |

*Source*: own calculations in STATGRAPHICS

The enterprises of first cluster have the highest ratio of external funds, from what we may conclude that this cluster consist mainly from commercial companies. These companies have the lowest number employees and also the lowest area per hectare.

Third cluster has the second lowest ratio of external funds (35,5%), from what we may conclude that this cluster consist mainly from cooperatives. These companies have the highest number of employees and also the highest area per hectare.

Second cluster has the lowest ratio of external funds (28,71%), but the number of employees, area per hectare is lower compared to third cluster.

In 2009 the sample consisted of 610 companies (cooperatives and commercial companies). The enterprises were examined again according to the same four indicators as in previous case, simultaneously.

***Table 6:*** *Cluster Summary of Selected Slovak Agricultural enterprises in 2009*

| *Cluster* | *Members* | *Percentage* | *Cumulative percentage* |
|---|---|---|---|
| 1 | 269 | 44,10 | 44,10 |
| 2 | 184 | 30,16 | 76,26 |
| 3 | 157 | 25,74 | 100,00 |

*Source*: own calculations in STATGRAPHICS and Excel

The enterprises were divided into three clusters. In first cluster were 269 enterprises, which represented 44,10 % from total number of examined (investigated) enterprises. In second cluster were 184 enterprises (30,16 % of total number of examined enterprises) and in third cluster 157 enterprises, which represented 25,74 % out of total.

***Table 7:*** *Cluster Analysis- Centroids of Selected Slovak Agricultural enterprises in 2009*

| *Cluster* | *Percentage of external funds* | *Area per hectare* | *Number of employees* | *Profit* |
|---|---|---|---|---|
| 1 | **0,6480** | 634,75 | 13,420 | 20762,0 |
| 2 | 0,2263 | 815,21 | 17,936 | 30688,4 |
| 3 | 0,3882 | **2526,36** | **64,949** | 148171,0 |

*Source*: own calculations in STATGRAPHICS

The enterprises of first cluster have the highest ratio of external funds, the lowest number employees and the lowest area per hectare. Third cluster has the second lowest ratio of external funds (38,82%), the highest number of employees and also the highest area per hectare. Second cluster has the lowest ratio of external funds (22,63%), but the number of employees, area per hectare is lower compared to third cluster.

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## Summary


In the paper the difference in funding between the two legal forms was confirmed. The indebtedness of commercial companies is considerably higher in both observed years (2003, 2009). Another finding is that during the observed period (2003-2009) the proportion of commercial companies with higher indebtedness increased significantly.

Since Slovakia joined the EU the amount of external sources has risen and it is still rising. But a positive respond in profitability of agriculture enterprises was not observed, as would be expected.

According to the Cluster Analysis the centroids of both legal forms were unprofitable in 2003. By comparison between the year 2003, the year in which Slovakia joined the EU and the year 2009, we observe an overall increase in the economic result from the negative to the positive integers. The year 2009 from the point of view of the farmers we can apperceive as a positive year in terms of the world prices, which were on the historical highest level. These prices were supported by a weak U.S. dollar.

In the paper the difference in management of the two legal forms was confirmed. In both observed years commercial companies have the highest ratio of external funds, the lowest number employees and the lowest area per hectare. And cooperatives can be characterized with the highest number of employees and also the highest area per hectare.



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