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The relationship between profitability and capital structure of the agricultural holdings in the Czech Republic

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Abstract: Decision on the capital structure of an enterprise is very important because a bad decision can affect a company's profitability leading to a decrease in the shareholders value. The good financial decision can increase the market value of the owners' equity and poor financial decisions can decrease it. The main objective of financial decisions is to maximize the wealth of stockholders. The effect that capital structure decisions have on profitability and enterprise value is that it increases value through the present value of tax savings from the use of debt. The enterprises can use debt or equity capital to finance their assets. The best what they do is to mixture the debt and equity. This paper analyses how far the capital structure affects the profitability of agricultural holdings in the Czech Republic for a period of six years from 2008 to 2013. Data was obtained from the Albertina and was analysed by using the descriptive statistics, the correlation analysis and the regression analysis. The results show that there is a negative relationship between the short-term debt to the total assets and profitability, between the long-term debt to the total assets and profitability, and between the total debt to the total assets and profitability.

Keywords: long-term debt, regression, return on equity, short-term debt, total debt

Capital structure represents the proportions of the financing of the enterprises from the long-term debt and equity. Neumaierová and Neumaier (1996) define the capital structure as a combination of stocks, bonds and bank loans. On the other hand, Kalouda (2011) define the capital structure as an element which is located on a long-term basis in the enterprise. The same opinion had Valach et al. (2010). Synek et al. (2011) said that the capital structure is especially the structure of liabilities of an enterprise. The capital structure decision is the choice between debt and equity and between the current and long-term debt. Especially the capital structure decision is the decision to rely on debt. Capital structure maximizes the value of the enterprise. And the capital structure decision involves a trade-off between the debt and the costs of the financial distress. An optimal capital structure is the combined effects of taxes and bankruptcy costs (Ross et al. 2009). Brealey et al. (2001) said that the capital structure decision is the choice of the long-term financing mix, made up of the debt and equity financing. The capital structure of an enterprise is a mix of securities. Generally, the enterprises can choose among many alternative capital structures. The enterprises can also issue dozens of securities to maximize their market value (Abor 2005).

The capital structure of agricultural holdings is differentiated. The effective set-up of the capital structure is the main aim of the financial management. The decision on the proportion of own and external sources of financing is very important for enterprises in terms of the future development. The general rule is that the external capital is cheaper than the own capital, because the risk is spread among the owners and creditors (Aulová and Hlavsa 2013). The enterprises can use the debt or equity capital to finance their assets. They should use a mix of the debt and equity because it is the best choice (Azhagaiah and Gavoury 2011). The use of debt in the capital structure of the enterprises leads to the agency costs. Agency

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costs arise as a result of the relationships between the shareholders and managers (Jensen and Meckling 1976). The access of agricultural holdings to the sources of funding is different because the business activities are carried out in a different economic environment and the enterprises have different objectives, strategies, mission, the ownership structure, the offered products, economic results etc. (Strýčková 2015).

The capital structure can be influenced by many different factors. These factors can be divided into the internal factors (such as the structure of assets, the return on assets, the cash flow, profitability) and the external factors, for example taxes, interest, the information asymmetry, competition etc. (Prášilová 2012).

There are two main theories of the capital structure – the optimal trade-off theory and the pecking order theory. The optimal trade-off theory said that the taxes and costs combine to yield, thereby there is acquired an optimal capital structure. This theory was mentioned for example by Choi (2015) and Morellec (2004). Choi (2015) stated that debt is not one-sided. But Kraus and Litzenberger (1973) mentioned that there exists a proportion between the tax debt and the bankruptcy. Morellec (2004) showed that the optimal capital structure reflects the agency costs of the managerial discretion. Valach (2008) expressed that the costs of financial distress must be included to the average costs. According to the pecking order theory, the capital structure is a result of the investment opportunities in the presence of the asymmetric information. The enterprises are faced by new investment opportunities and they strive to moderate the unfavourable selection costs. This theory was mentioned for example by Myers and Majluf (1984). Myers and Majluf (1984) pointed out that financing debt by the external funds is better than financing by using the equity

The analysis of the relationship between capital structure and profitability was subject over the past decade. Modigliani and Miller (1958) state, in their research, that the capital structure is independent to the enterprise value. Modigliani and Miller (1963) added that the market value of the enterprise is positively related to the amount of the long term debt used in its capital structure.

Modigliani and Miller (1958) argued that the financial leverage does not affect the enterprise's market value. On the other hand, Sarkar and Zapatero (2003) found out a positive relationship between the leverage and profitability.

The main aim of this paper is to contribute to an aspect of financial management known as the capital structure with reference to the Czech Republic, especially to analyse the relationship between profitability and the capital structure of the agricultural holdings (farmers' cooperatives, limited liability companies and joint-stock companies) in the Czech Republic for a period of six years from 2008 to 2013. There will be applied statistical techniques in investigating the relationship between profitability and the capital structure.

In this article, there were formulated the following minor hypotheses:

– H1: There is no relationship between the short-term debt to the total assets and profitability.
– H2: There is no relationship between the long-term debt to the total assets and profitability.
– H3: There is no relationship between the total debt to the total assets and profitability.

MATERIALS AND METHODS

Data were obtained from the database of companies Albertina for a period of six years from 2009 to 2013. There were analysed 1572 agricultural holdings, i.e. 393 cooperatives, 706 limited liability companies and 473 joint-stock companies. These were selected businesses focusing their activities on the crop and animal production.

The set of variables includes six factors - three ratios of the short-term debt to the total assets, the long-term debt to the total assets, the total debt to the total assets and furthermore the sales growth, the firm size, and profitability (i.e. return on equity).

The return on equity (ROE) is defined as the ratio of earnings to equity. This ratio measures the rate of return on the ownership interest (i.e. the shareholders' equity) of the stock owners. It is used for measuring a company's efficiency at generating profits from every unit of the shareholders' equity (i.e. net assets or assets minus liabilities). This indicator shows how well a firm uses investment funds to generate the earnings growth. It is calculated as the net income divided by the average equity (Hoque 2006).

The short-term debt to the total assets (SDtTA) is defined as the short-term-debt over the book value of the total assets. It is calculated as short-term debt divided by total assets (Renneboog 2006).

The long-term debt to the total assets (LDtTA) represents the percentage of an enterprise's assets

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that are financed with loans and financial obligations lasting more than one year. It provides a general measure of the financial position of an enterprise, including its ability to meet financial requirements for the outstanding loans. It is calculated as the long-term debt divided by the total assets (Mayo 2010).

The total debt to the total assets (TDtTA) is a ratio which measures the percentage of the enterprise's assets that is financed with debt. It is a leverage ratio that defines the total amount of debt to assets. This enables comparisons of the leverage to be made across different enterprises. The higher the ratio, the higher the degree of leverage. It is calculated as the total debt divided by the total assets (Gallagher and Andrew 2002).

Size is calculated as a natural logarithm of the company's sales. Sales are calculated as the sales change indicator, i.e. the current year's sales minus the previous year's sales divided by the previous year's sales.

In this article, there is used descriptive statistics to describe and summarize the behaviour of the variables. In order to test the research hypotheses, the correlation analysis is used (Anderson 2011). Especially, there belong the mean, median, minimum, maximum, the standard deviation, the coefficient of variation, skewness and kurtosis.

The standard deviation is used to quantify the amount of variation of a data value (Lewis 2012). The formula (1) is following:

$$s = \sqrt{s^2} = \sqrt{\frac{\sum \left(X_i - \overline{X}\right)^2}{n-1}} \tag{1}$$

where s is the standard deviation, X_i are the observed values of the sample, $\overline{X}$ is the mean, and n is the sample variance.

The coefficient of variation (2) measures the relative dispersion by calculating a number that is defined as the ratio of the variable's standard deviation divided by its arithmetic mean (Bachman 2004):

$$CV = \frac{s}{\overline{X}} \cdot 100 \tag{2}$$

where CV is the coefficient of variation, s is the standard deviation and $\overline{X}$ is the mean.

The indicators of shape are skewness and kurtosis and they describe an asymmetry of the probability distribution of a random variable about its mean (Lewis 2012).

There is also used the correlation coefficient and the coefficient of determination, the t-test, F-test and the Durbin-Watson statistic.

The coefficient of determination (3) is used in the multiple regression models in which more than one independent X variable is considered. The coefficient shows how well a multiple regression model explains the changes in the value of the dependent Y variable or how much of the variability in the response variable is explained by the explanatory variable. It is the proportion of the total variation in the dependent variable explained by the full set of independent variables. This coefficient is the square of the coefficient of the multiple correlation (Lang and Secic 2006; Hirschey 2008):

$$R^2 = \frac{variation\ explained\ by\ regression}{total\ variation\ in\ Y} \tag{3}$$

where R^2 is the coefficient of determination.

The t-test is used to test single hypotheses, the hypotheses involving only one coefficient. In the F-test, there are required two regressions, known as the unrestricted and the restricted regressions. The unrestricted regression is the one in which the coefficients are restricted. The T-test statistic (4) for testing the multiple hypotheses about the coefficient estimates is given by (Brooks 2002):

$$F\ test = \frac{RRSS - URSS}{URSS} \times \frac{T-k}{m} \tag{4}$$

where $RRSS$ is the residual sum of squares from the restricted regression, $URSS$ is the residual sum of squares from the unrestricted regression, T is the number of observations, k is the number of regression in the unrestricted regression and m is the number of restrictions.

The Durbin and Watson statistic can be used for testing for the autocorrelation. The formula (5) is the following (Baltagi 2011):

$$d = \frac{\sum_{t=2}^{T} \left(e_t - e_{t-1}\right)^2}{\sum_{t=1}^{T} e_t^2} \tag{5}$$

where d is the Durbin-Watson statistic, e_t are the residuals for time t, and T is the sample of data.

Also there is used the statistical analysis. The purpose of statistics is to summarize and answer questions that were obtained in our work. The upper level of the statistical significance for testing of the hypotheses was set at 5%. The statistical analysis involves the descriptive statistics, the correlation analysis and the regression analysis. The four linear regression models are used in this paper:

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$$ROE = \alpha_0 + \alpha_1 \cdot SDtTA_{it} + \alpha_2 \cdot size_{it} + \alpha_3 \cdot sales_{it} + e_1 \quad (6)$$

$$ROE = \beta_0 + \beta_1 \cdot LDtTA_{it} + \beta_2 \cdot size_{it} + \beta_3 \cdot sales_{it} + e_2 \quad (7)$$

$$ROE = \lambda_0 + \lambda_1 \cdot TDtTA_{it} + \lambda_2 \cdot size_{it} + \lambda_3 \cdot sales_{it} + e_3 \quad (8)$$

$$ROE = \delta_0 + \delta_1 \cdot SDtTA_{it} + \delta_2 \cdot size_{it} + \delta_3 \cdot sales_{it} + e_4 \quad (9)$$

The models will be estimated by the ordinary least square (OLS) method:

$$\hat{\beta} = (X'X)^{-1} X'y \quad (10)$$

where $\hat{\beta}$ is the matrix of the regression coefficients, X is the matrix of the regressors (i.e. the explanatory variables), and the vector y contains the values of the explained variable, in our case the return on equity ratio (Hansen 2014).

RESULTS AND DISCUSSION

In this section, the results of the correlation and regression analysis are presented. Firstly, the Table 1 and 2 summarize the descriptive statistics of the extracted data.

The content of the Table 1 consists of the mean, median, minimum and maximum of the respective variables during the monitored period of 2008–2013. The mean is higher than the median for the first three variables, i.e. the calculated ratios of the return on equity, the short-term debt to the total assets and the long-term debt to the total assets, what means that there are some extreme values in the data. The mean is lower than the median for the rest of the variables, i.e. the total debt to the total assets ratio, size and the sales change indicators, which might mean that there are no big extreme values in the data set. However, this is not true for the values of the sales change indicator. Also it is illustrated that the total debt to the total assets is consisted from about 60% at the maximum and from about 50% at the minimum from the long term debt to the total assets. The highest variation range, i.e. the difference between the maximum and minimum value, is the one for the sales change indicator and the lowest is the one for the short-term debt to the total assets ratio. However, the C.V. in the Table 2 is a better statistical characteristic to see the true variation of the variable.

Table 2contains the values of the following calculated measures of the data set: the standard deviation, the coefficient of variation (C.V.), the skewness and the ex. kurtosis for all the variables used in this paper.

The sales change indicator has the highest value of the standard deviation during the monitored period as the sales are influenced the most by the effect of the crisis and the followed recovery. The lowest value of the standard deviation is the one for the short-term debt to the total assets ratio. The same is true for sales in the case of the coefficient of variation (C.V.), i.e. the ratio of the standard deviation to the mean, as a better descriptive statistic. The highest value of the C.V. is the one for the sales change indicator and the lowest one for the size indicator. The variability of sales is so high thanks to the variation of the agricultural output and thus the returns of the agricultural companies. Also the C.V. is over 1 in the case of the sales change indicator which means a quite high variability. The values of the C.V. for the rest of the variables are below 1, which means a low variability during the monitored period. Also the values of skewness show a low or no asymmetry of the return on equity ratio and the size indicator close to a normal distribution and a higher asymmetry of the short-term debt to the total assets ratio and the sales change indicator. The negative excess kurtosis for the most of the variables except for the sales indicator means bigger positive and negative values.

Table 1. Descriptive measures, using the observations 2008–2013

Variables	Mean	Median	Minimum	Maximum
ROE	0.0474	0.0426	0.0074	0.0834
SDtTA	0.1751	0.1743	0.1703	0.1840
LDtTA	0.2335	0.2366	0.2143	0.2520
TDtTA	0.4087	0.4114	0.3846	0.4291
Size	8.1762	8.1740	8.1299	8.2219
Sales	0.0593	0.0873	–0.1709	0.1754

Source: Albertina database, own processing

Table 2. Descriptive measures, using the observations 2008–2013

Variables	Std. Deviation	C. V.	Skewness	Ex. kurtosis
ROE	0.0283	0.5972	0.0259	–1.1373
SDtTA	0.0050	0.0286	0.8680	–0.3538
LDtTA	0.0152	0.0652	–0.2194	–1.4647
TDtTA	0.0186	0.0455	–0.1999	–1.5993
Size	0.0384	0.0047	0.0225	–1.6978
Sales	0.1249	2.1054	–1.1068	0.0148

Source: Albertina database, own processing

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Table 3. Correlation matrices for the capital structure and profitability (Pearson correlation), 5% critical value (two-tailed) = 0.8114

Variables	ROE	SDtTA	LDtTA	TDtTA	Size	Sales
ROE	1.0000					
SDtTA	–0.0817	1.0000				
LDtTA	–0.2421	0.5832	1.0000			
TDtTA	–0.2202	0.7470	0.9757	1.0000		
Size	0.8445	0.2658	–0.1701	–0.0676	1.0000	
Sales	0.7976	0.1148	0.0230	0.0498	0.5873	1.0000

Source: Albertina database, own processing

Table 3 lists the results of the correlation analysis. The coefficients of correlations are calculated among all of the variables analysed in this paper. The quite high positive correlation coefficients between the short-term debt to the total assets ratio, the long-term debt to the total assets ratio and the total debt to the total assets ratio is quite explained by the definitions of those ratios. The same is true for the high positive correlation between the return on equity ratio and the sales change indicator.

Also the correlation between the size indicator and the return on equity ratio is quite high, which might means that the economies of scales overweighed in the monitored holdings.

The hypotheses of the paper are only partly proved because the correlation coefficients between the return on equity ratio and the debt ratios, i.e. the short-term debt to the total assets ratio, the long-term debt to the total assets ratio and the total debt to the total assets ratio, respectively, are negative, but very low, mainly in the case of the short-term debt to the assets ratio (–0.0817). The very low negative correlation between the debt ratios and the return on equity ratio seems to mean a low effect of the respective term debt and the total debt and its changes on the profitability of the Czech agricultural holdings.

Table 4 table contains the main results of the regression analysis using the OLS method. All the models are statistically significant according to the *p*-values of the *F*-tests. Also the coefficients of determination (R^2) are quite high (mostly over 0.80 except for the last model).

The regression coefficient of the short-term debt to the total assets ratio from the first model equals to –1.7479, which means that if the short-term debt to the total assets increases by 1, the return to equity ratio decreases by 1.75. The regression coefficient of the long-term debt to the total assets ratio from the second model is –0.3040, which could be interpreted as that an increase in the long-term debt to the total assets ratio by 1 is associated with a decrease in the return on equity ratio by 0.304. The regression coefficient of the total debt to the total assets ratio is equal to -0.3161, which means that an increase in the total debt to the total assets ratio is connected with a decrease in the return on equity ratio by about 0.32.

However, the *p*-values of the *t*-tests for the regression coefficients statistical significance are much higher than the 5% probability level (0.05). So the values of the regression coefficients are not statistically significant.

Table 5 summarizes the values of the Durbin-Watson statistic for all three linear regression models and the variance inflation factors for all explanatory variables in all three models. There is no autocorrelation in the estimated linear regression models according to the

Table 4. Regression models, R^2 and beta-coefficients of the first variable x_1 in each model

Regression model	R^2	*F*-test (*p*-value)	Reg. coefficients for debt ratios (*p*-value of *t*-test)
$ROE = \alpha_0 + \alpha_1 SDtTA_{it} + \alpha_2 size_{it} + \alpha_3 sales_{it} + e_1$	0.9410	10.6322 (0.08719)	–1.7479 (0.2246)
$ROE = \beta_0 + \beta_1 LDtTA_{it} + \beta_2 size_{it} + \beta_3 sales_{it} + e_2$	0.8774	4.7714 (0.1781)	–0.3040 (0.5860)
$ROE = \lambda_0 + \lambda_1 TDtTA_{it} + \lambda_2 size_{it} + \lambda_3 sales_{it} + e_3$	0.8945	5.6529 (0.1540)	–0.3161 (0.4643)
$ROE = \delta_0 + \delta_1 SDtTA_{it} + \delta_2 LDTA_{it} + \delta_3 size_{it} + \delta_4 sales_{it} + e_4$	0.7223	4.2509 (0.3470)	–2.0665 (0.4701) 0.1529 (0.8443)

Source: Albertina database, own processing

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Table 5. Regression model, Variance Inflation factors (VIF) (collinearity problem) and Durbin-Watson statistics (autocorrelation problem)

Regression model	VIF (>10 collinearity problem)	D-W statistic (*p*-value)
$ROE = \alpha_0 + \alpha_1 SDtTA_{it} + \alpha_2 size_{it} + \alpha_3 sales_{it} + e_1$	1.079/1.625/1.531	2.6913 (0.8064)
$ROE = \beta_0 + \beta_1 LDtTA_{it} + \beta_2 size_{it} + \beta_3 sales_{it} + e_2$	1.055/1.609/1.564	3.3715 (0.7373)
$ROE = \lambda_0 + \lambda_1 TDtTA_{it} + \lambda_2 size_{it} + \lambda_3 sales_{it} + e_3$	1.017/1.549/1.545	3.2057 (0.5950)
$ROE = \delta_0 + \delta_1 SDtTA_{it} + \delta_2 LDTA_{it} + \delta_3 size_{it} + \delta_4 sales_{it} + e_4$	2.001/1.956/2.092/1.635	2.8258 (0.6102)

VIF(j) = 1/(1 – $R(j)$^2), where $R(j)$ is the multiple correlation coefficient between the variable j and the other independent variables (Hansen 2014)

Source: Albertina database, own processing

p-values of the Durbin-Watson statistic higher than 0.05. Also there are no collinearity problems in the models according to the variance inflation factors lower than 10.

CONCLUSIONS

During the financial and economic crisis and mainly during the recovery period, the returns of the agricultural holdings and their debt structures varied considerably. The problem of the effect of the term structure of the debt on the returns of the agricultural firms is worth analysing. However, other factors influencing the returns in agriculture might play a more important role.

The sales change indicator reports the highest variation and the size indicator and the short-term debt to the assets ratio the lowest variation during the monitored period of 2008–2013 in case of the Czech agricultural holdings.

According to the correlation analysis, the hypotheses of this paper are partly true, mainly for the short-term debt to the total assets ratio where the correlation coefficient is close to zero, i.e. no relationship. The correlation coefficients for the long-term debt to the total assets ratio and the total debt to the total assets ratio are small and negative.

According to the regression analysis, the hypotheses of this paper were not fulfilled. The regression coefficients were negative and non-zero. However, the regression coefficients were not statistically significant according to the *t*-test.

The results for the paper hypotheses are summarized in the Table 6. The results showed that all three hypotheses must be rejected because there is a relationship between the short-term debt to the total assets and profitability, between the long-term debt to the total assets and profitability and between the total debt to the total assets and profitability.

Our results are consistent with Mendell et al. (2006). They stated a negative relationship between the profitability and debt across the enterprises in the forest industry. On the contrary, Gill et al. (2011) concluded that there is a positive relationship between the short-term debt to the total assets and profitability, between the long-term debt to the total assets and profitability and between the total debt to the total assets and profitability in the manufacturing industry. Also Abor (2005) contend that there is a positive relation between the ratio of the short-term debt to the total assets and profitability and a negative relationship between the ratio of long-term debt to the total assets and the return on equity.

Chiang et al. (2002) observed, in their work that profitability and capital structure are interrelated.

Table 6. Tested hypotheses

Number	Hypotheses	Tools	Results
H1	There is no relationship between short-term debt to total assets and profitability.	regression analysis	rejected
H2	There is no relationship between long-term debt to total assets and profitability.	regression analysis	rejected
H3	There is no relationship between total debt to total assets and profitability.	regression analysis	rejected

Source: Albertina database, own processing

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Raheman et al. (2007) found out a significant effect of the capital structure on the profitability for non-financial companies.

This paper tried to contribute to the financial analyses of the agricultural holdings in the Czech Republic and to evaluate the influence of the short-term and long-term debt on the profitability of the firms. Nevertheless, a much deeper and complex analysis and a more sophisticated econometric model should be processed to fully see the true financial situation of the analysed subjects.

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