

DUPONT ANALYSIS OF COMPANIES IN THE SLOVAK REPUBLIC ENGINEERING INDUSTRY

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Abstract

Profitability ratios provides quick picture of companies' financial situation, but they do not have such explanatory power than overall financial analysis. The decomposition of the return on equity according to DuPont equation allows deeper analysis of the component ratios' impact, whose multiplication is return on equity. Exist more modification of return on equity breakdown. In this paper we used the variant, in which the return on equity is the multiplication of profit margin, assets turnover and equity multiplier. The impact of single component to the change of return on equity were examined by regression and correlation analysis. As a result, statistical analysis highlighted that the DuPont equation is useful tool for financial analysis. The most significant effect to return on equity has component asset turnover, profit margin and the least significant impact has equity multiplier.

1. Introduction

The subject of the paper is analysis of changes in return on equity (ROE) caused by their components according to DuPont equation. ROE was investigated in the Slovak Republic engineering industry companies. This sector of industry with automotive industry represent driving force of the Slovak economy. The engineering industry has strong historical background, stable position, represents growing and key pillar in Slovak industry. This is evidenced by the fact that sales generated in the engineering industry grew at an average annual rate of 13 %, while the average annual growth rate in overall industry is at level 2.9 % (SARIO, 2017). Business activity efficiency of engineering industry companies were analyzed using financial analysis indicators, which reflects efficiency by financial and monetary value factors (Lacko, Hurný, & Rozkošová, 2017). To assess the business activity efficiency are used information from financial accounting, primarily from financial statements (Lovciová, 2017). In order to make financial decision based on financial statements is crucial to be applied the principle of the true and fair view and characteristics such as clarity and accuracy are also important (Juhászová et al., 2014; Kubaščíková & Juhászová, 2016). For the purpose of decision making, the user of the information must determine the weight to be assigned to the individual indicators (Dechow et al., 2013). Development of information and communication technologies and the application of optimization methods for solving problems ensures greater business efficiency, more flexible performance of organizations in the market, accelerating transactional operations, reducing logistics costs and increasing profits (Mijailović et al., 2015).

2. Return on equity according to DuPont equation

Profitability ratios are used to measure ability of company to generate new resources, respectively making profit by invested capital (Šlosárová & Blahušáková, 2017). ROE is the most important ratio for stakeholders, because evaluates the profitability of equity. Based on ROE stakeholders of the company assess, whether the resources they invested to business create profit (Blahušáková, 2017). ROE does not replace the overall financial analysis and does not provide an overall picture of the financial situation (Kharatyan, Nunes & Lopes, 2017; Prajapati & Danta, 2015). The basis for the ROE decomposition is DuPont equation, which was used in the 20's of the 20th century by DuPont Corporation first. Previous studies indicate, that components of DuPont equation resulting from the ROE decomposition have an explanatory power relating the changes of future profitability (Soliman, 2007). DuPont analysis links balance sheet with the profit or loss statement and allows identification of stronger and weaker aspects of financial performance (Kharatyan, Nunes & Lopes, 2017). For example, a high positive ROE may look great. However, it is not excluded that the company got to large losses and both loss and equity are negative (Cvik & MacGregor Pelikánová, 2016), but reflect a highly positive ROE due to mathematical rules, when two negative values are eliminated. ROE decomposition allows assessment of strong and lagging aspect of business activities, which implies giving a more realistic picture than ROE alone (Prajapati & Danta, 2015). DuPont equation is processed in the literature from different points of view, from which we present the most frequently applied modification. In the original DuPont equation, the return on assets (ROA) is calculated as follows (1):

$$ROA = \frac{Net\ profit}{Sales} \times \frac{Sales}{Asset\ turnover} = \frac{Net\ profit}{Asset\ turnover} \quad (1)$$

Till 70's of the 20th century the main objectives of companies were measured based on ratio ROA, which was influenced by profitability and efficiency. Later more attention was devoted to liabilities and debt and the position of ROA deteriorated against ROE (Kharatyan, Nunes & Lopes, 2017). ROE represents the proportion of net profit to shareholder's equity and can be calculated by multiplying ROA and equity multiplier (2). ROE decomposition consists of ROA components as we mentioned above and is completed with equity multiplier (3, 4).

$$ROE = ROA \times \frac{Total\ assets}{Shareholder's\ equity} \quad (2)$$

$$ROE = Profit\ margin \times Assets\ turnover \times Equity\ multiplier \quad (3)$$

$$ROE = \frac{Net\ profit}{Sales} \times \frac{Sales}{Total\ assets} \times \frac{Total\ assets}{Shareholder's\ equity} \quad (4)$$

The individual components of the modified DuPont equation represent all main areas of financial analysis. In term of profitability is presented profit margin, the assets are reflected in ROE through asset turnover, and the last component is equity multiplier, which is related to the indebtedness.

The profit margin indicates how much net profit is generated by one euro of sales. The low profit margin rate means that high expenses reduce income accounted for unit of sales. Asset turnover of total assets serves to assess the company's performance and expresses how many euros of sales accounts for one euro of asset. Equity multiplier reflects the proportion of own resources and debt, so the growth of ratio is due to the increase of debt needed for business activities financing. The equity multiplier shows how many euros of assets accounts for one euro of equity.

Another modification of DuPont equation is the decomposition of ROE to multiplication of five ratios by extending profit margin indicator (Grashuis, 2017). Modification of DuPont equation that breaks ROE into five indicators allows better investigation and understanding of the various financial aspects of company (Prajapati & Danta, 2015). Profit margin in this modification is multiplication of following indicators: tax burden ratio, interest burden ratio and EBIT margin (5). In this paper will be practically applied the first modification and will be used the decomposition of ROE to three components: the profit margin, asset turnover and equity multiplier.

3. Data and methodology

The aim of this paper is to analyze return on equity and the components responsible for its change based on the DuPont equation on the sample of engineering industry companies in the Slovak Republic. The impact of ROE components was examined through regression and correlation analysis on the selected sample of companies based on data from accounting period 2016, drawn from the Financial Statements Register and the web portal Finstat. Into the sample of analyzed companies were selected 59 companies from engineering industry with a minimum of 200 employees. The total number of examined companies is 58, because we excluded one company from the sample since only data for accounting period 2017 were available and subject of examination is accounting period 2016.

Using statistical methods such as regression and correlation analysis were applied to evaluate effect of individual components to the change of ROE. According to Šoltés (2008), nowadays first of all concept regression means, the study of mutual relations between two or more variables through statistical model, which characterizes the dependence between them. Regression model represents a simplified expression of relations between variables using a mathematical formula. In regression model we distinguish explanatory (independent) and response (dependent) variables. An inseparable part of the regression analysis is correlation analysis, which through correlation characteristics allows to assess the intensity of dependence between variables. One of the assumptions of regression analysis is no dependence between explanatory variables. The relationship between response variable Y and explanatory variables is expressed by linear regression model as follows:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik} + \varepsilon_i \quad (5)$$

Where: $\beta_0, \beta_1, \dots, \beta_k$ are the model parameters,

x_{ij} - i^{th} value ($i = 1, 2, \dots, n$) of explanatory variable X_j ($j = 1, 2, \dots, k$).

An absolute member – the coefficient β_0 is called intercept and represents averaged mean value of Y assuming that all explanatory variables are zero. Such an assumption is in many cases unrealistic, but its inclusion into the model is necessary. β_0 together with the random error reflects the effect of not considered and not included factors on the dependent variable. Coefficients β_j ($j = 1, 2, \dots, k$) are called regression coefficients that indicate how the increase or decline in the mean value of dependent variable Y corresponds to the unit increase of independent variable X_j at unchanged values of other independent variables. This interpretation of regression coefficients is correct only assuming mutual independence of explanatory variables. In practical applications, explanatory variables are at least partially dependent, so this interpretation is considered simplified (Šoltés, 2008). Regression analysis was performed using statistical program PSPP.

Based on theoretical analysis were determined the following hypotheses:

H_0 : The components of ROE such as profit margin, asset turnover and equity multiplier are not statistically significant predictors of return on equity.

H_1 : The components of ROE such as profit margin, asset turnover and equity multiplier are statistically significant predictors of return on equity.

4. Results

One of the key tasks of regression analysis is the correct identification of dependent and independent variables. Inclusion of too many variables can reduce the significance and uniqueness of independent variables due to multicollinearity. Multicollinearity shows the presence of dependence between independent variables, which interrupt the basic assumption of regression analysis regarding the independence of explanatory variables (Prajapati & Danta, 2015). Response (dependent) variable in this case is indicator ROE, that depends on explanatory (independent) variables such as profit margin, asset turnover and equity multiplier. Before executing regression analysis were examined mutual dependences between all independent variables by correlation coefficients.

Table 1 Correlation of return on equity components

Pearson correlation coefficient	Profit margin	Asset turnover	Equity multiplier
Profit margin	1	0.23 (0.081*)	-0.06 (0.649)
Asset turnover	0.23 (0.081*)	1	0.25 (0.055*)
Equity multiplier	-0.06 (0.649)	0.25 (0.055*)	1

Notes: p-values shown in parentheses besides correlations; *, ** indicate statistical significance at 10 percent and 5 percent confidence levels.

Source: Author's calculations based on Finstat data retrieved on 19.03.2018 using PSPP program

The correlation of the ROE components is included in Table 1, which includes results of 58 observations. The correlation between profit margin and equity multiplier is weak and negative, while correlation of asset turnover to profit margin and equity multiplier reflects also weak but positive relationship. P-values in parenthesis: 0.081; 0.649 and 0.055 are above the significance level of $\alpha = 0.05$ and we consider them to be statistically insignificant. At the level $\alpha = 0.1$ p-values of equity multiplier and profit margin dependence with asset turnover indicate statistically significant weak dependence. In the model is no strong multicollinearity, so we can continue with regression analysis.

Table 2 Regression model summary

Model summary	R	R square	Adjusted R Square	Std. Error of the Estimate
Values	0.90	0.81	0.80	8.01

Source: Author's calculations using Finstat data retrieved on 19.03.2018 using PSPP program

R value (Table 2) is 0,9, which is close to 1 and states that there is a strong relationship between explanatory and response variables. R square expresses how many percent of dependent variable variability affect independent variable. Adjusted R square also expresses the effect on dependent variable and fits for models with more independent variables. In this model, independent variables so profit margin, asset turnover and equity multiplier affect 80 % of ROE variability.

Table 3 Parameter characteristics of linear regression model

ANOVA	Sum of Squares	Df	Mean Square	F	Sig.
Regression	14 928.47	3	4 976.16	77.47	0,000
Residual	3 468.57	54	64.23		
Total	18 397.04	57			

Source: Author's calculations using Finstat data retrieved on 19.03.2018 using PSPP program

P-value (Sig.) shown in Table 3 equals 0.000 and indicates that the regression model is statistically significant at the level of significance $\alpha = 0.1$ and $\alpha = 0.05$. Testing characteristic $F = 77.47$, whose value is greater than the critical value $F_{1-\alpha}(k; n - k - 1) = F_{0,9}(3,54) = 2.188$ at the significance level $\alpha = 0.1$ and $F_{0,95}(3,54) = 2.776$ at the significance level $\alpha = 0.05$, shows significance of the statistical model.

Table 4 Regression equation coefficients

Regression model coef.	Unstandardized coefficients		Stand. coefficients	t	Sig.
	B	Std. Error	Beta		
Intercept	- 3.62	2.71	0.00	-1.34	0.187
Profit margin	1.83	0.14	0.78	12.69	0.000
Asset turnover	5.93	1.88	0.20	3.15	0.003
Equity multiplier	0.80	0.16	0.31	4.99	0.000

Source: Author's calculations using Finstat data retrieved on 19.03.2018 using PSPP program

Based on Table 4 the regression equation from unstandardized coefficients is as follows:

$$Y = -3.62 + 1.83 X_1 + 5.93X_2 + 0.80 X_3 \quad (6)$$

$$ROE = -3,62 + 1,83 \textit{ Profit margin} + 5,93 \textit{ Asset turnover} + 0,80 \textit{ Equity multiplier} \quad (7)$$

Intercept b_0 equals $- 3.62$ and represents the average value of the ROE under assumption, that all three explanatory variables equal to zero. Since this value is negative, the absolute member b_0 does not have a logical interpretation. The regression coefficient $b_2 = 1.83$ indicates that a positive unit change of profit margin causes 1.83 % growth of ROE, while other conditions remaining the same. Profit margin increase. Positive impact on ROE has increase of profit margin, which can be reached by higher growth of net profit than sales. It points out appropriate control of expenses and economic efficiency of inventory consumption and production inflows. The regression coefficient $b_3 = 5.93$ is responsible for 5.93 % ROE growth by positive one-unit change of asset turnover ratio, while other conditions remaining the same. If the coefficient is higher than one, the company has achieved higher sales than the value of the assets for the accounting period and the company's performance can be judged as fair. A high asset turnover ratio results from the efficient use of assets and also has a positive impact on ROE. Profit margin and asset turnover tend to have inverse relationship, according to which a high profit margin is present in companies with low assets turnover ratio and vice versa (Ďurišová & Myšková, 2010). Management is required to establish reachable goals for performance measurement and can't focus only on maximizing of both indicators which are mutually exclusive. However, in our sample from engineering industry between asset turnover and profit margin is weak but direct proportion according to results of correlation analysis. 0.8 % growth of ROE under

unchanged values of other explanatory variables causes positive unit change of equity multiplier expressed as a regression coefficient $b_4 = 0,80$. A high level of the equity multiplier is a positive feature, when profitability of invested capital is higher, than the amount of interest paid for debt. Increase in indebtedness makes the ROE grow. But debt of the company has a positive impact on the ROE until ROA is higher or equal than interest expense multiplied by $(1 - \text{tax rate})$, when this is not true, the debt starts to be detrimental to the company (Saxunova, 2014). The inverse relationship is predominant between equity multiplier and asset turnover. In the case of low asset turnover is a need for debt financing instruments (Ďurišová & Myšková, 2010). Indebtedness negatively and significantly affects financial performance of the company, because highly indebted companies may be at risk of bankruptcy, if they are unable to pay liabilities. High indebtedness is a barrier, when looking after new investors in future. Then a higher level of liabilities leads to decrease of investments to non-current assets and ultimately reduces the value of the company (Kim, 2016).

P-values (Sig.) for all explanatory variables are lower than the significance level $\alpha = 0,1$ and $\alpha = 0,05$, based on which we reject the null hypothesis. We reject that ROE components such as profit margin, asset turnover and equity multiplier are not statistically significant predictors of ROE. Similar results were concluded by Karathyn et al. (2016) according to which, the most significant impact on ROE have asset turnover and equity multiplier based on linear regression model. Prajapati & Danta (2016) investigated ROE decomposition in Indian pharmaceutical industry, where ROE development was affected the most significantly by asset turnover and EBIT margin. Kijewska (2016) identified EBIT margin as responsible for ROE decrease in Polish metallurgical and mining industry. EBIT margin as we mentioned above is a component of DuPont equation composed from five indicators.

5. Conclusion

The assessment of companies' effectiveness is from the view of management decision making required and different mathematical and statistical methods are used to assess the financial performance. At present get to the focus analyzes of large volumes of data and identifying different relationships among them, whose appropriate interpretation allows faster responses of management to a rapidly changing environment. In this paper was applied regression and correlation analysis to determine the impact of indicators such as profit margin, asset turnover and equity multiplier to change of ROE. At the theoretical level the starting point of our investigation was DuPont equation, which indicates positive dependence between ROE and analysed indicators. To estimate the extent in which the profit margin, asset turnover and equity multiplier affect ROE was used regression analysis of data from the financial statements of companies operating in Slovak Republic. The impact of components on ROE has been investigated on a sample of companies in engineering industry, which includes more large manufacturing companies. The engineering industry cooperates closely with the automotive industry and represents the driving force of the Slovak economy. In this paper was concluded that the regression model based on component indicators is a significant predictor of ROE in engineering industry companies. We accepted the alternative hypothesis and rejected the null hypothesis determined on the basis of theoretical assumptions as follows: *"The components of ROE such as profit margin, asset turnover and equity multiplier are not statistically significant predictors of return on equity."*

The most significant impact on ROA has asset turnover ratio, while the equity multiplier has the least significant impact. Profit margin can be characterized as component with a moderate impact. The regression model equation allows prediction of ROE in the future especially in the engineering industry with certain limitations. The analysis was based on data from one accounting period, from year 2016 and we abstracted from changes in the business environment. For example, significant risk in engineering industry may arise from import tariffs set by USA on steel and for aluminum. Even though Slovakia is not a significant export partner of the USA, but indirectly in companies operating

in automotive and engineering industry with German and South Korean ownership may reflect positive and also negative impacts caused by worldwide development.

The paper points out that DuPont equation is a suitable tool for financial analysis. If the goal of the management or owners is an increase in ROE, the attention should be paid not only to the amount of net profit, but also to the asset turnover ratio, which has the most significant impact on ROE. Based on the results of this paper, is recommended as a subject of further analysis the comparison of the ROE decomposition according to DuPont equation with five components and also the extension of analysis for more accounting periods and industries.

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