

ANALYSIS OF RELATIONSHIP BETWEEN RISK AND FINANCIAL RATIOS IN CASE OF ROMANIAN SMALL AND MEDIUM-SIZED ENTERPRISES

Edina Kulcsár

University of Oradea, Faculty of Economic Sciences, Oradea, Romania

Partium Christian University, Faculty of Economic Sciences, Oradea, Romania

kulcsaredina@yahoo.com

Abstract: *According to imperfect market principle, in small and medium sized enterprises' business activity, the phenomenon of risk is always present. As a consequence of last great recession, the importance of risk management has accented. Enterprises and financial institutions handle more carefully their finances and pay more attention to their partners. The aim of present research consists in examination of relationship between risk and financial ratios. In this paper, we considered that the risk could be divided into operating risk, which is calculated by using Degree of Operating Leverage (DOL) and financial risk, expressed by Degree of Financial Leverage (DFL). The reason why we chose Romanian small and medium-sized enterprises is they are important on aspect of GDP stimulation and jobs creation. The data used for present analysis is ensured by simplified financial reports of 204 small and medium-sized enterprises registered in Bihor County between 2009 and 2012. The selected enterprises are operating in manufacturing (22,55%) and trading (77,45%) industry. The used financial ratios could be listed in four categories: liquidity, financial leverage, profitability and turnover. The used statistical methods for illustration of relationship between risk and financial ratios are: correlation analysis, multivariate linear regression, and stepwise linear regression. In case of correlation analysis, we could observed a weak relationship between these two types of leverage and financial ratios, both for manufacturing and trading firms. The result of applying multivariate regression model shows in case of manufacturing sme's greater relation between operating risk and current, quick liquidity, receivables turnover, return on sales (ROS) and return on assets (ROA). Degree of financial leverage (DFL) could be well explained by receivables turnover, as an independent variable. In case of trading firms, operating risk is related with current and cash liquidity, receivables turnover, return on sales (ROS). Degree of financial leverage could be characterized by total debt ratio. We could find similar results with few exceptions if the stepwise regression analysis is applied. The difference between last two methods consists in levels of significance of the explanatory variables, which are more favorable in the case of last method. Overall, we could state, from the investigated three methods, the stepwise regression analysis is the most appropriate for examination of relationship between operating, financial risk and above mentioned 12 financial ratios.*

Keywords: risk, degree of operating leverage (DOL), degree of financial leverage (DFL), financial ratios, correlation, multivariate linear stepwise regression,

JEL classification: G3, G30, G32, G33

1. Introduction

As a consequence of the great recession of last years, the operational and financial risk increased significantly in case of corporate' an financial institutions' sectors. As an answer to this, both financial institutions and private companies try to handle it their finances more carefully and pay more attention for those external resources. Taking into account this aspects, the risk management, proven one of the most valuable and useful pillars of the

corporate decision-making. Therefore, the article aims to examine the corporate' operating and financial risk, and as well theirs managing possibilities by financial ratios based on the annual financial reports.

2. Review of literature

In many international articles, we can read about the relationship between risk and financial indicators. According to Huldah (1996), there are more financial ratios which explain well the risk; some of these are liquidity and leverage ratios. The size of assets and their growth trend also affect the corporate risk (Ohlson, 1980).

Proper values and stable trend of financial indicators reflect a less risky activity. According to Bajkowski (1990), the high level of quick liquidity ratio indicates a lower level of financial risk. Those companies which are less liquid and profitable are able to manage more actively their risks (Rochet and Villeneuve, 2010).

In domestic and foreign literature two components of corporate risk are mentioned, financial and operating or business risk. Appointing of risk components is not randomly, the corporate risk is influenced by the way of company functioning, cost policy and external sources funding types and conditions. Company specific risk also could be included in operating, or business risk. In corporate finance, the leverage effect appears in results, so the operating and financial leverage ratios are often used for risk quantification. These leverage indicators are sensitivity and elasticity indices and their calculation are based on historical data. Although, these are declared traditional risk quantification methods, could be considered reliable risk measurement methods in comparison with modern risk quantification methods. The degree of operating leverage (DOL) shows the effect of turnover changes compared with operational results changes. This indicator shows that the 1% sales rise how many percentage of change produces in operational results.

However, the degree of operating leverage (DOL) could be considered the function of fixed costs of company (Ross et.al, 2007). It is also well-known the break-even point based calculation of this indicator. According to Illés (2007), more noticeable correlation could be found between break-even point and degree of operational leverage (DOL).

The degree of financial leverage (DFL) shows how many percentage change of net result is caused by operational result change. The degree of financial leverage (DFL) is greatly affected by the external capital costs.

In the investigation of relationship between risk and financial ratios we used ratios which could be listed in four categories: liquidity, financial leverage, turnover and profitability. The mentioned financial ratios are presented is the following table.

Table 1. List of financial ratios used in present analysis

Ratio category	Ratio
Liquidity	Current liquidity
	Quick liquidity
	Cash liquidity
Financial leverage	Total debt
	Debt/Equity
	Equity multiplier
Turnover	Inventory turnover
	Receivables turnover
	Payables turnover
Profitability	Return on Sales (ROS)

Ratio category	Ratio
	Return on Assets (ROA)
	Return on Equity (ROE)

3. Research methodology

The aim of article is studying the relationship between corporate risk and financial ratios. In present research we studied two basic types of risk, the operational and financial risk. We analyzed the relationship between operational and financial risk and financial ratios by using of simplified financial reports of 204 small and medium-sized enterprises' registered in Bihor County. The companies included in present research are operating in various sectors of Romanian economy, 46 of them in manufacturing (22.55%) and 158 in trading (77.45%). The financial annual reports of studied companies were collected for four years between 2009 and 2012. The main reason why we chose Romanian small and medium-sized enterprises is the fact that they are important on aspect of GDP stimulation and for jobs creation, cause 90% of Romanian active population work in small and medium-sized enterprises. The analysis of small and medium-sized enterprises it is also important because 97% of OECD member countries' companies are small and medium-sized enterprises. Due to their specific characteristics, small and medium-sized enterprises are more sensitive and vulnerable to the changes of economic environment, so their restructuring or transformation is much more difficult. In the analysis of relationship between risk and financial ratios we explored three statistical methods. Firstly, we used the correlation analysis, where the Pearson's correlation coefficient was determined. Furthermore, the multivariate linear regression were applied to determine the relationship between operational and financial risk, as dependent variable and 12 above mentioned financial ratios, as explanatory, independent variables.

The regression models of degree of operating leverage (DOL) and degree of financial leverage (DFL) the 12 financial ratios are presented below:

$$DOL = X_0 + X_1 * \text{Current liquidity}_i + X_2 * \text{Quick liquidity}_i + X_3 * \text{Cash liquidity}_i + X_4 * \text{Total debt}_i + X_5 * \text{Debt/Equity}_i + X_6 * \text{Equity multiplier}_i + X_7 * \text{Inventories turnover}_i + X_8 * \text{Receivables turnover}_i + X_9 * \text{Payables turnover}_i + X_{10} * \text{Return on Sales (ROS)}_i + X_{11} * \text{Return of assets (ROA)}_i + X_{12} * \text{Return on Equity (ROE)}_i$$

$$DOL = X_0 + X_1 * \text{Current liquidity}_i + X_2 * \text{Quick liquidity}_i + X_3 * \text{Cash liquidity}_i + X_4 * \text{Total debt}_i + X_5 * \text{Debt/Equity}_i + X_6 * \text{Equity multiplier}_i + X_7 * \text{Inventories turnover}_i + X_8 * \text{Receivables turnover}_i + X_9 * \text{Payables turnover}_i + X_{10} * \text{Return on Sales (ROS)}_i + X_{11} * \text{Return of assets (ROA)}_i + X_{12} * \text{Return on Equity (ROE)}_i$$

After the estimation of parameters of multivariate linear regression model, we used the coefficient of determination and correlation for estimation of relationship between operational and financial risk and financial ratios. We also appreciate the validity of models by using variance analysis, the F-test value. After that we apply the stepwise regression analysis in "backward" direction that helps to determine those independent variables, which explain in better way both of investigated corporate risk indicators. The "backward" method differs from the "forward" method, because this withdraws those variables, which have the smallest effect on the dependent variable (Fenyves, 2014). The essence of stepwise regression is to determine those independent variables, which are most closely related with dependent variable. The scope of this method consists in determination of the simplest and most appropriate model that could be used for dependent variable prediction (Garcia and Filzmoser, 2015). At the application of stepwise regression analysis, the independent variables were determined by taking into account the Akaike Information Criterion (AIC). During the execution the stepwise method, this method tries to reduce the

achieved AIC value by the original model (Rawlings et. al., 1998). The great part of calculation was performed in R statistics program system. In the program are available all the packages (modules) required for present research. Several modules were used for current calculations: cor() module for correlation analysis, lm() function for regression analysis, which was completed by step() command for performing the stepwise regression analysis.

4. Results of research

As we mentioned above, in the analysis of relationship between operating and financial risk and financial ratios, first we used correlation analysis. The calculations were carried out both for manufacturing and trading firms separately. The results are presented in the following table.

Table 2. Correlation analysis for **manufacturing** and **trading** firms (2009-2012)

Source: Own calculation

	Manufacturing firms		Trading firms	
	DOL	DFL	DOL	DFL
Current liquidity	-0.0605	-0.1318	0.0000	0.0360
Quick liquidity	0.0250	-0.1588	0.0304	0.0222
Cash liquidity	0.0754	-0.0911	0.0484	0.0496
Total debt	-0.1638	0.1456	-0.1115	-0.1578
Debt/Equity	0.0459	-0.1843	-0.0022	-0.0910
Equity multiplier	0.0446	-0.1819	-0.0009	-0.0928
Inventory turnover	0.0064	-0.1199	-0.0078	-0.0253
Receivables turnover	-0.0031	-0.2231	-0.0495	-0.0025
Payables turnover	0.0482	-0.0662	-0.0269	0.0054
Return on Sales (ROS)	0.1089	-0.0486	0.1508	0.0355
Return on Assets (ROA)	0.3227	0.0325	0.0394	0.0553
Return on Equity (ROE)	-0.0687	-0.0181	-0.0001	-0.0351

As we can see from the table, the results of the correlation analysis show

a relatively weak, low correlation between degree of operating leverage (DOL), degree of financial leverage (DFL) and 12 financial ratios. In case of manufacturing firms, we can see a low-intensity connection between degree of operating leverage (DOL) and total debt ratio, return on sales (ROS) and return on assets (ROA). In case of degree financial leverage (DFL) there can be see a low relationship between first two liquidity ratios, total debt ratio, and receivables turnover ratio. At trading small and medium-sized enterprises, the degree of operating leverage (DOL) is in indirect relationship between total debt ratio and in direct relationship with return on sales (ROS). At the degree of financial leverage (DFL) we detected only a weak, indirect correlation with total debt ratio. As a result of this analysis, we can see that correlation analysis is not the best method for determination of the relationship between risk indicators and financial ratios. In the next step, we used multivariate regression analysis both for two risk indicators for manufacturing and trading firms. The following table presents the degree of operating (DOL) and financial leverage (DFL) multivariate regression functions' coefficients and their significance levels for manufacturing companies.

Table 3. Estimation the parameters of DOL and DFL multivariate linear regression function in case of **manufacturing** firms

Statistical attributes	DOL		DFL	
	Estimation	Pr(> t)	Estimation	Pr(> t)
Intercept	1057.357	0.40437	-25.81057	0.634
Current liquidity	-847.323	0.01640	-2.26289	0.876
Quick liquidity	958.554	0.05926	-3.95427	0.852
Cash liquidity	-68.271	0.89256	7.02922	0.746
Total debt	-696.631	0.38334	39.22627	0.255
Debt/Equity	309.324	0.61996	-14.55807	0.587
Equity multiplier	-325.404	0.60292	14.09962	0.600
Inventory turnover	-5.780	0.40840	-0.04188	0.888
Receivables turnover	16.789	0.03594	-0.45820	0.174
Payables turnover	-11.419	0.82420	1.38349	0.532
Return on Sales (ROS)	-4068.430	0.07118	56.56759	0.550
Return on Assets (ROA)	5569.755	0.00261	-9.20593	0.901
Return on Equity (ROE)	-238.418	0.38019	0.14806	0.990
Standard error of regression	688.4		29.56	
Determination coefficient (R ²)	0.3595		0.1653	
Correlation coefficient (R)	0.5995		0.466	
Variance analysis F-value test	1.544	0.158	0.5448	0.8689

Source: Own calculation

According to significance levels of regression coefficient, the degree of operating leverage (DOL) dependent variable is explained by the evolution of 5 indicators from 12. This affirmation is not true in case of degree of financial leverage (DFL), where only one indicator explained the dependent variable evolution. For manufacturing companies, degree of operating leverage (DOL) could be significantly explained by return on assets (ROA), receivables turnover, current and quick liquidity ratios and return on sales (ROS). At the degree of financial leverage (DFL) dependent variable we could see that regression coefficient significance levels take higher values, which isn't favorable. We could observe the lowest value at the receivables turnover independent variable, what means that this ratios is well related with degree of financial leverage (DFL). Table 3. shows the coefficient of determination (R²) for each functions, that is 0.3595 for degree of operating leverage (DOL) and 0.1653 for degree of financial leverage (DFL). This means that in case of degree of operating leverage (DOL), the dependent variable variance could be explained by independent variable in proportion of 35.95%, while in the case of degree of financial leverage (DFL), this is only 16.53%. We could also see in table 3. the results of coefficient of correlation (R), which is 0.5995 in case of degree of operating leverage (DOL) and 0.466 in case of degree of financial degree (DFL), so in operational risk case we could see a medium-strong relationship and a medium-weak correlation in financial risk case.

Table 4. Estimation the parameters of DOL and DFL multivariate linear regression functions in case of **trading** firms

Statistical attributes	DOL		DFL	
	Estimation	Pr(> t)	Estimation	Pr(> t)
Intercept	7.680e+01	0.2218	1.218e+01	0.0291
Current liquidity	-7.290e+00	0.0973	9.076e-02	0.8143

Quick liquidity	-4.682e+00	0.6228	-8.267e-01	0.3258
Cash liquidity	3.871e+01	0.0753	1.547e+00	0.4188
Total debt	-8.678e+01	0.2791	-1.276e+01	0.0724
Debt/Equity	-5.639e+00	0.5939	1.168e+00	0.2119
Equity multiplier	5.860e+00	0.5897	-1.253e+00	0.1925
Inventory turnover	-9.526e-04	0.9147	-3.228e-04	0.6811
Receivables turnover	-2.240e-03	0.6875	9.180e-05	0.8519
Payables turnover	-7.159e-01	0.5376	-1.038e-01	0.3117
Return on Sales (ROS)	6.514e+02	0.0953	-1.373e+01	0.6891
Return on Assets (ROA)	-2.454e+02	0.2488	7.719e+00	0.6806
Return on Equity (ROE)	8.501e-01	0.9441	-1.693e+00	0.1150
Standard error of regression	124.1		10.96	
Determination coefficient (R²)	0.06219		0.06466	
Correlation coefficient (R)	0.2494		0.2542	
Variance analysis F-value test	0.8013	0.6487	0.8353	0.6141

Source: Own calculation

At the trading firms, the evolution of degree of operating leverage (DOL) variable is explained by three financial ratios from liquidity and profitability ratios groups. In this case, the dependent variable is defined by current and cash liquidity, return on sales (ROS). In the case of degree of financial leverage (DFL) variable only one independent variable effect could be considered significantly, namely total debt ratio that is indirectly related with dependent variable. The coefficient of determination (R²) related to operating (6.219%) and financial (6.466%) degree of leverage functions, are in both of cases lower than at manufacturing firms. This also means that the variance of dependent variable couldn't be explained with variance of independent variables' variance. The coefficients of correlation are also lower, 24.94% for operational risk and 25.42% for financial risk, so this shows a low-intensity relationship between risk and financial ratios.

After the examination of risk models for both two sectors' companies, we could state, that the multivariate regression analysis, as risk management and anticipation method, could be considered much more effective in case of manufacturing firms. In order of more accurately estimation of regression model's parameters, we used the "backward" version of stepwise analysis. The method starts from the first multivariate regression model and eliminates step by step those independent variables, which are not related with dependent variable.

Table 5. The results of multivariate linear stepwise regression in case of **manufacturing and trading firms**

	Manufacturing firms		Trading firms	
	DOL	DFL	DOL	DFL
Intercept	-77.185 (0%)	25.834 (1%)	12.900	8.366 (1%)
Current liquidity	-712.306(0.1%)		-7.118 (5%)	
Quick liquidity	831.687 (1%)	-9.8320		
Cash liquidity			29.506 (5%)	
Total debt				-11.219 (1%)
Debt/Equity				
Equity multiplier				
Inventory turnover				
Receivables turnover	10.827(1%)	-0.3670 (5%)		
Payables turnover				

	Manufacturing firms		Trading firms	
	DOL	DFL	DOL	DFL
Return on Sales (ROS)	-3324.717 (5%)		751.252 (1%)	
Return on Assets (ROA)	5417.965 (0%)		-225.185	
Return on Equity (ROE)				
Correlation coefficient (R)	0.5544	0.3259	0.2165	0.1578
Variance analysis F-value test	3.551	2.556	1.882	3.985

Source: Own calculation

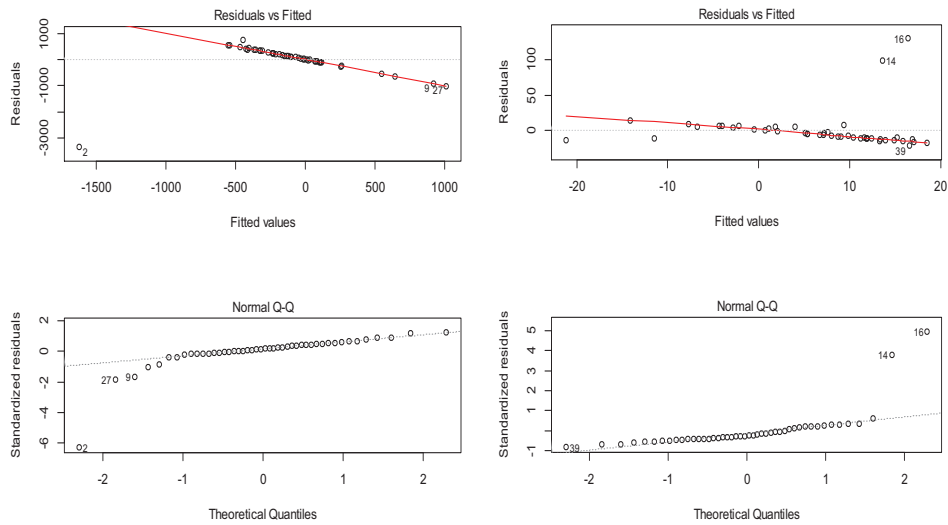
By applying of stepwise regression analysis, we could see that degree of operating leverage (DOL) of manufacturing firms is well explained by current and quick liquidity, receivables turnover, return on sales (ROS) and return on assets (ROA). We could observed, that the group of independent variables are the same with that resulted after applying multivariate regression analysis, but the great difference consists in fact that significance level linked to regression coefficients' are better in the last case. At degree of financial leverage (DFL) only one indicator could be identified as explanatory variable, receivables turnover.

In case of trading small and medium-sized enterprises, the operating risk is mainly determined by the following ratios: current and quick liquidity, return on sales (ROS) and return on assets (ROA). In comparison with regression analysis, here is present the slight influence of return on assets (ROA). In case of degree of financial leverage (DFL), as the multivariate regression analysis, the total debt corresponds to an explanatory variable. By the examination of correlation coefficient, excepting the manufacturing small and medium-sized enterprises, where a medium-strong correlation could be observed, we could found a low-intensity relationship between risk and financial ratios.

Although, may be some overlap between two applied methods, in term of explanatory variables, in our opinion, the stepwise regression analysis allows a more precise, more transparent and more comprehensive approach, so we believe that the last used method is one which suit best for examination of relationship between risk and financial ratios.

Further, we check the availability of models by representing in the following graphs the residuals as a function of observed values (Huzsvai, 2012). This method helps to show the relationship between the dependent variables and residuals (Everitt and Hothorn, 2014)

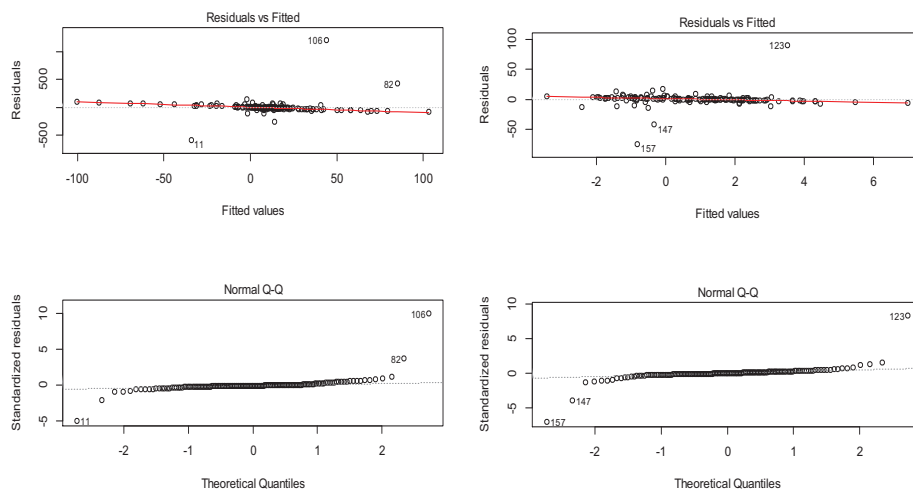
Graph 1. Plot of residuals against fitted values and normal probability plot of residuals for DOL and DFL for **manufacturing** firms



Source: Own calculation

In case of manufacturing firms, we can see the linear shaped correlation both at degree of operating (DOL) and financial leverage (DFL). As we demonstrated with previous methods, in case of operating risk we could see from the graph. 1 a closer relationship. Both of two models, we can detect outlier values, which clearly influence the quality of models. The normal distribution test was performed using Q-Q charts. It is evident in both models, the majority of the residual values are located along the theoretical diagonal, only few outliers can be seen.

Graph 1. Plot of residuals against fitted values and normal probability plot of residuals for DOL and DFL for **trading** firms



Source:

Own calculation

In the case of trading firms, both of two leverage show acceptable linear relationship, but here we can see much more number of outlier values than in case of manufacturing firms.

Degree of leverage (DOL) establishes stronger relationship.

Q-Q representations show that most of residual values are situated along the theoretical diagonal, excepting few outliers.

Overall, it could be concluded, after applying the independence test that in case of manufacturing small and medium-sized enterprises, both at two investigated models it is a closer relationship between dependent and independent variables.

5. Conclusion

Examination of relationship between risk and their affecting factors is an important tool of corporate risk management. In present article the relationship between risk and financial indicators was analyzed with three methods: correlation analysis, multiple linear regression and stepwise regression analysis. The results of first method show weak, low-level relation between degree of operating (DOL) and financial leverage (DFL) both for the manufacturing and trading small and medium-sized enterprises, so the analysis could be expanded. By applying the multivariate regression analysis, we could found that in case of manufacturing companies, current and quick liquidity ratios, receivables turnover, return on sales (ROS) and return on assets ratios are decisive in operating risk estimation. At financial risk, the receivables turnover is the independent variable. By analyzing the trading firms, we could found that current and cash liquidity, receivables turnover and return on sales explain well the operational risk. Degree of financial leverage (DFL) is well represented by total debt ratio.

Similar results were obtained, with few exceptions by applying the stepwise analysis, but in this case the significance levels linked by explanatory variables were much more favorable.

Overall, we consider that from the three investigated methods, the stepwise regressions analysis is which treat in most convenient way the context of relationship between operational and financial risk and the examined 12 financial ratios.

References

1. Bajkowski, J.,(1999) „Financial ratio analysis: Putting the numbers to work”, AAIL Journal
2. Everitt, B., E. and Hothorn, T.(2014) „A Handbook of Statistical Analyses using R” Third edition, Taylor& Francis Group LLC.
3. Fenyves, V. (2014) „Vállalati teljesítményértékelés pénzügyi mutatók és a DEA felhasználásával”, Acta Scientiarum Socialium? Kaposvár
4. Garcia, H. and Filzmoser, Peter.(2015) „Multivariate statistical analysis using the R Package chemometrics”,
5. Huldah, A. R. (1996) “The use of financial ratios as measures of risk in the determination of the bid-ask spread”, Journal of Financial and Strategic Decisions, Vol. 9, No. 2
6. Huzsvai, L. (2012) „Statisztika. Gazdaságelemzők részére Excel és R alkalmazások” Seneka Books, ISBN: 978-963-08-5016-2
7. Illés, Ivánné (2007) „Vállalkozások pénzügyi alapjai”, SALDO Pénzügyi Tanácsadó és Informatikai Zrt.,Budapest, 213 p.
8. Ohlson, J. (1980) “Financial Ratios and the Probablistic Prediction of Bankruptcy,” Journal of Accounting Research, Spring 1980, pp. 109-131
9. Rawlings, J.O. and Pentula, S.G. and Dickey, D.A. (1998) „ Applied regression analysis: a research tool” 2nd edition., Springer. ISBN 0-387-98454-2
- 10.Rochet, J., Ch. and Villeneuve, S. (2010) „Liquidity Management and Corporate Demand for Hedging and Insurance”
- 11.Ross, S. and Westerfield, R. and Jordan, B. (2007)” Fundamentals of Corporate Finance”, Sixth Edition, Alternate Edition, McGraw-Hill/Irwin.