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## Use of Risk Analysis in Investment Measurement and Management

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### Abstract

Business risk is assessed in relation to specific criteria of efficiency valuation of the investment activity. By using risk analysis, available methods and techniques applied in risk analysis as tool of investment measurement and management, the company obtains information that will support its decision and on this basis it can better decide in acceptance or rejection of the investment. We focused in our paper on investment risk analyses applied in tested firms. We tried in our research detect if companies in research sample apply any investment risk analysis, what kinds, methods or concept of risk evaluation they use. The main goal was to find out if using of certain risk analysis has the impact into business performance. We have collected data through questionnaire. Research sample consisted from 164 firms from Slovakia. We applied certain statistical methods suitable for tested variables. Results of our research has shown, that companies using some risk analysis, achieved a slightly higher performance.

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### 1. Introduction

Each investment activity in the company is accompanied by risk and uncertainty; therefore the enterprise in everyday decisions must accept and consider their impact on future profits. Subsequently after detection of risks, their sources and impact on the success of the project can be taken the measures to reduce the risk to the acceptable level.

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The issue of business risk - its principles, acceptance, evaluation and reflection of the impact increasingly affects not only the permanent business activity, but also his role in planning and implementing new investments. This situation results from the still ongoing economic and financial crisis. To perceive the business risk just as the word is not possible, because the non-acceptance in all areas of its impact can signify decline of business efficiency.

In our research paper we focus on investment risk analysis. The research objective was to analyze relationships between the use of investment risk analysis and performance given by the indicator Return on Equity (ROE). The goal was to find out statistically relevant evidence that risk method applied in company has an impact in better performance of companies and so it is important element in investment decision making.

## 2. Material and Methods

The allocation of available financial resources to fixed assets or investments in modernization of production technologies are possible ways when a company can ensure its prosperity (Merková, Drábek, 2014). Investment decisions (how much, to what, when, where and how to invest) belong among fundamental decisions, which greatly affect the future development of the company and its efficiency (Sujová, Hlaváčková, Šafařík, 2015). In order to ensure right decision relating to these investments, it is necessary to evaluate their economic benefits and also to analyze the risk that is inherently associated with investing. It is not possible to develop business activity without taking the acceptable level of risk. To find a suitable and acceptable balance between undergoing risk and a potential profit is difficult. Identification of business risks and the newest procedures of risk quantification are not themselves able to prevent bad decision and subsequent economic loss.

Appropriately selected risk categories, a clear definition of the content and boundaries between categories are the basis for a well-structured systematic process of identifying business risks (Rybářová, Grisáková 2010). Among the tools and resources that can be used to identify risk factors are for example check lists, discussions and interviews, audits, results of financial controlling and financial analysis, but also the various analyzes of internal and external business environment, whether it is a SWOT analysis, STEEP analysis, mind maps, brainstorming method, etc. It should be emphasized that the identification of project risk factors is the most important and time-consuming phase of risk analysis. It requires experience, a systematic approach and ability to predict possible future situations.

Order to determine the significance of risks is possible to use sensitivity analysis - where risk factors are able to quantify, or expert evaluation which assesses the factors which are not able to quantify and they are evaluated verbally (Merková, Drábek, Jelačič, 2013).

The results of the identification and determination of the significance of the crucial factors are the basis for the next phase of risk analysis what is the quantification or measurement of risk (Drábek, Polách, 2008). Later in decision process, information about ambient positions and consequences of the decision alternatives is a fundamental classification aspect of decision-making processes. From this perspective are distinguished certain types of decisions: under certainty, risk, uncertainty and indefinite conditions (Varcholová, Dubovická, 2008). In order to e.g. comparing two investment options, it is necessary to express the risk (risk of failure or risk of another negative effect) in some way (Smejkal, Rais 2009). The risk of the project can be determined numerically, where the starting point is to determine the probability distribution of one of the basic economic criteria (eg profit) for evaluation. The risk can be determined directly, however, it is more difficult and expects to apply some of the tools of risk decision making (decision matrix, decision trees, probability trees, computer simulation, using models). The risk can be also determined indirectly, with certain characteristics, which together provide information about the greater or lesser degree of risk of the project (Polách et al, 2012). The most common method of measuring risk is a statistical method variance, standard deviation and coefficient of variation (Královič et al., 2008); very common indicator of the project risk is a statistical method of variance and standard deviation of the cash flows (Hrdý, 2008).

Risk is unavoidable part of any entrepreneurship, so it is very important to make its analysis, but, paradoxically at the same time, it is one of the most underestimated parts of the project (Drábek, Jelačič, Merková, 2014). If the company succeeds in improving the efficiency of its processes, part of the avoided costs can be reflected in the launch of new investment so far not provided services and products (Sujová, Šimanová, 2013). Just the results of risk analysis and discovering the causes of risk can increase business efficiency.

As a starting point in this paper we formulated and tested the hypothesis, we formulate the null hypothesis  $H_0$  and alternative  $H_1$ :

**$H_0$ :** The use of investment risk analysis does not affect the performance of enterprises in terms of the ROE indicator.

**$H_1$ :** Using of investment risk analysis affects the business performance. We assume this tool of investment measurement and management is applied in enterprises that achieve better performance, according the ROE indicator more than 4%. Vice versa, if companies do not use any risk analysis, we will statistically prove that they are not powerful.

Methodologically, there was created on-line questionnaire through internet application to build data collection of companies in Slovakia (more in *Questionnaire Survey* or *Rajnoha et al., 2013*). We maintain complete anonymity of participating firms. The size of research sample was 164 counts.

Companies were initially analyzed according the distribution of the achieved performance of the 6 particular groups (Groups 0-5, group 0 – the worst performance with negative ROE, Group 5 - the highest performance with the ROE over 10%).

We have used mathematical and statistical methods in the research of interdependencies and impacts of individual factors on achieved performance of companies.

One-dimensional inductive statistics:

In research, we analyzed selected descriptive statistics for one variable – absolute and relative frequencies, cumulative frequency and cumulative relative frequency, mean, median and mode. Statistical methods were used: frequency tables showing the frequency by categories, histograms, pie charts, bar and cumulative bar charts, time series and trends.

Cumulative bar graph represents the best way of graphical representation of the relationship between a pair of categorical variables. In fact, it is a graphical representation of row or column percentages in contingency table (Rimarčík, 2007).

Two-dimensional inductive statistics between categorical variables:

We applied analysis of variance (ANOVA) in the research. The purpose of ANOVA (Shapiro, Wilk, 1965, Iversen, Norpoth, 1976 and others) is to test differences in means (for groups or variables) for statistical significance. For testing of homogeneity of variances we used Levene's test. Levene's test is an inferential statistic used to assess the equality of variances for a variable calculated for two or more groups (Levene, 1960).

For statistical analysis, numeric and graphical presentation of the research results, we used the program MS Office Excel and Statistic software from StatSoft, Inc.

### 3. Results and discussion

Possibilities and ways of assessing risk investments, we analyzed in the question of where businesses could choose only one of the five responses:

- Without methods
- Additional increase of interest rate
- Spread in cost of capital
- Sensitivity risk analysis
- Math-statistical methods

The results show (Fig. 1), the most numerous category (55%) is the answer “without method of investment risk analysis”. We can state that companies in Slovakia mostly do not custom to use risk methods.

When analyzing the various categories of risk analysis (Table 1) we found that the use of mathematical and statistical methods were recorded in a small range of 5.49%, but most businesses reached the fourth performance group with ROE 4-7%. Businesses that apply sensitivity risk analysis, most placed in the third performance group with 2-4% ROE. The highest frequency (30 businesses) is in the category which do not apply the analysis of risk in the investments, the performance of group 1 of very low ROE to 2%, lower frequency (in the range of 8-17) were relatively evenly distributed in other categories (Fig. 2). This fact, the most significant category is clearer presented

in Fig. 3, where we did not selected single risk methods, but we sorted data only into two groups – without or with use of some risk analysis.

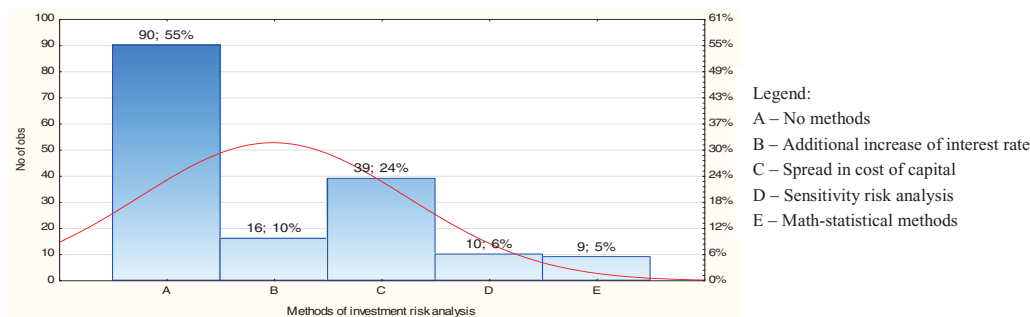


Fig. 1. Histogram of observed relative frequencies: Methods of investment risk analysis in companies.

Table 1. Observed frequencies: Methods of investment risk analysis in companies.

Methods of investment risk analysis	Group 0 ROE<0	Group 1 ROE: 0-2%	Group 2 ROE: 2-4%	Group 3 ROE: 4-7%	Group 4 ROE: 7-10%	Group 5 ROE>10%	Row Totals
<b>No method</b>	13	30	17	13	8	9	<b>90</b>
Share in category	14.44%	33.33%	18.89%	14.44%	8.89%	10.00%	
Share in total	7.93%	18.29%	10.37%	7.93%	4.88%	5.49%	<b>54.88%</b>
<b>Additional increase of interest rate</b>	1	6	2	1	0	0	<b>10</b>
Share in category	10.00%	60.00%	20.00%	10.00%	0.00%	0.00%	
Share in total	0.61%	3.66%	1.22%	0.61%	0.00%	0.00%	<b>6.10%</b>
<b>Spread in cost of capital</b>	9	8	9	3	3	7	<b>39</b>
Share in category	23.08%	20.51%	23.08%	7.69%	7.69%	17.95%	
Share in total	5.49%	4.88%	5.49%	1.83%	1.83%	4.27%	<b>23.78%</b>
<b>Sensitivity risk analysis</b>	1	2	6	3	1	3	<b>16</b>
Share in category	6.25%	12.50%	37.50%	18.75%	6.25%	18.75%	
Share in total	0.61%	1.22%	3.66%	1.83%	0.61%	1.83%	<b>9.76%</b>
<b>Math-statistical methods</b>	1	1	1	6	0	0	<b>9</b>
Share in category	11.11%	11.11%	11.11%	66.67%	0.00%	0.00%	
Share in total	0.61%	0.61%	0.61%	3.66%	0.00%	0.00%	<b>5.49%</b>
<b>Counts total</b>	25	47	35	26	12	19	<b>164</b>
<b>Share total</b>	15.24%	28.66%	21.34%	15.85%	7.32%	11.59%	<b>100.0%</b>

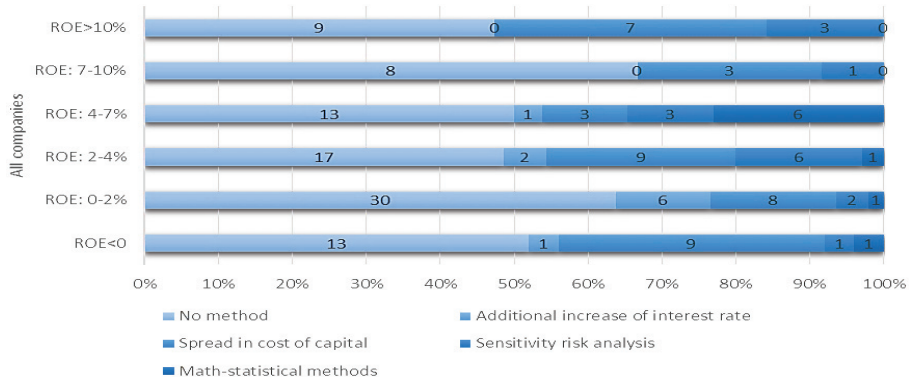


Fig. 2. Cumulative bar chart: Methods of investment risk analysis.

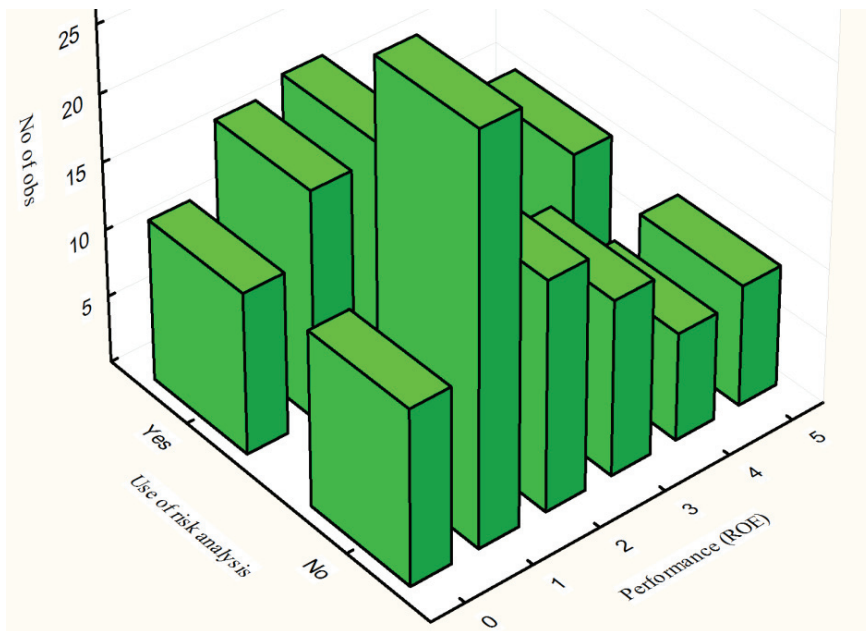


Fig. 3. Bivariate Distribution: Use of risk analysis vs. Performance (ROE).

Data of averages (see Table 2) show that the highest performance is achieved, when companies apply sensitivity risk analysis, in contrast, low performance is at an additional increase of capital cost. These facts can be evaluated in a way that firms increase their performance away from the simplicity and uncertainty (how much to increase additionally the capital cost?) into precise methodological approach (quite challenging, but precisely formulated sequence of steps in the sensitivity analysis). It cannot, however, say that if companies exclude the investments risk analysis, achieve a lower performance.

Table 2. Average performance in categories: Methods of investment risk analysis.

Methods of investment risk analysis	No method	Sensitivity risk analysis	Spread in cost of capital	Additional increase of interest rate	Math-statistical methods	All categories
All companies	2.000	2.625	2.102564	1.300	2.333	2.0609

The analysis presented in Tab. 3 reveals that Levene test determined the p-value  $p > 0.05$ , whereby we did not reject the null hypothesis of equal variances; assumption for ANOVA test was fulfilled. In the ANOVA test, p-value was  $p > 0.05$  (0.579) and thus not statistically significant dependence of performance in relation to analyzed risk methods.

Table 3. Analysis of variance: Use of investment risk analysis vs. Performance.

Levene test of homogeneity of variances								
Use of investment risk analysis	SS - Effect	df - Effect	MS - Effect	SS - Error	df - Error	MS - Error	F	p
Performance (ROE)	0.050666	1	0.050666	130.0735	162	0.802923	0.063102	0.801977
Analysis of variance (ANOVA)								
Use of investment risk analysis	SS - Effect	df - Effect	MS - Effect	SS - Error	df - Error	MS - Error	F	p
Performance (ROE)	0.741595	1	0.741595	390.6486	162	2.411411	0.307536	0.579961
Statistics: Performance (ROE)								
Use of investment risk analysis	Performance (ROE) - Means	Confidence -95.000%	Confidence +95.000%	Performance (ROE) - N	Performance (ROE) - Std.Dev.			
No	2.000000	1.679809	2.320191	90	1.528751			
Yes	2.135135	1.768666	2.501604	74	1.581783			
All categories	2.060976	1.822044	2.299907	164	1.549570			

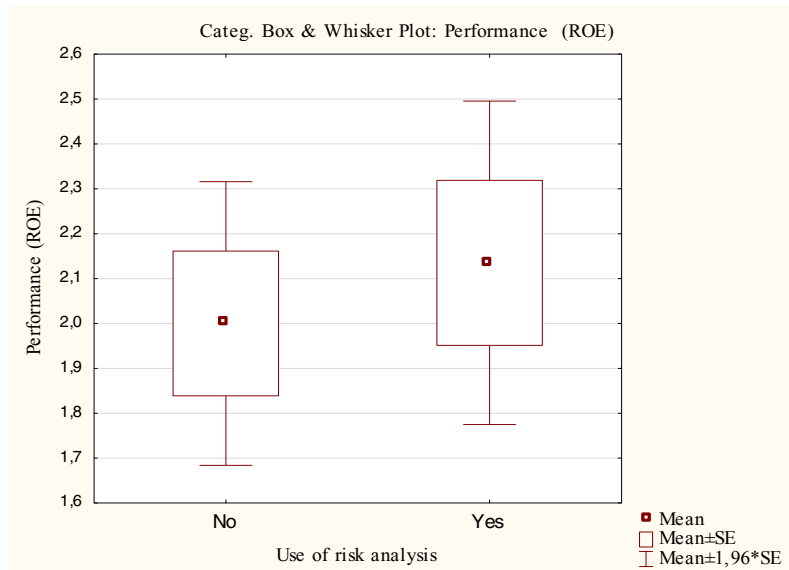


Fig. 4. Box Plot: Use of investment risk analysis vs. Performance.

As we can see from the box plot in Fig. 4, companies with using of some (in this case without specification) risk analysis, obtain better business performance, but not such significantly better to demonstrate it statistically. We assume, however, we can not guarantee, if a company implement some risk analysis, it will improve its performance. Use of investment risk analysis as a tool of investment measurement we consider as factor with an influence into better business performance.

#### 4. Conclusion

On the basis of statistical results we have made the decision on the hypothesis formulated at the beginning of the study: We do not reject null hypothesis  $H_0$ . Dependence of business performance on using of investment risk analysis was not statistically proven. Although we believe that risk analysis is an important element of investment measurement and management, we can not prove it by statistical analysis used in our research sample. However, positively we can describe slight improvement in performance with using of risk analysis presented in box plot, so we recommend to company investment management to apply risk analysis in decision making.

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