

Emerging Markets Queries in Finance and Business

## Multiple regression analysis of performance indicators in the ceramic industry

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### Abstract

The present study is a large part proposed within the PhD thesis, which has the aim of enhancing the performances of industrial enterprises with mathematical models. The main goal is to increase the competitiveness, flexibility, adaptability and reactivity of enterprises in the ceramic industry. Since the ceramic sector represents an important part in the manufacturing industry, we focused on this sector, with the aim of evaluating the development of enterprises activating in this domain. The importance of this research lies in its uniqueness and effectiveness, as the performance indicators were analyzed with multiple regression analysis, in the case of an enterprise that produces technical ceramic products. This analysis generally belongs to the multivariate methods, and it is also an explanatory method of analysis. Regression analysis describes the relationship between a dependent variable and several independent variables. The dependent variable consisted in the size of the profit, while the independent variables were the following: self-financing capacity, return on equity, degree of technical endowment, personnel cost per employee and investment per person employed. The selected variables were monitored throughout ten years. The results showed that three of the variables analyzed are very significant predictors for the magnitude of profit. We could also find significant correlations between the analyzed indicators.

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*Keywords:* analysis of variance; Student test; coefficient of determinations –  $R^2$ ; multivariate analysis of dependencies.

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### 1. Introduction

Industry represents one of the main sectors of national economy, having a pivotal role in achieving and maintaining a high rate of sustainable economic growth [Industrial policy, Chapter 15]. Nowadays, even during

the crisis, companies appeal to the newest and most effective methods in order to enhance their performance levels which are essential to occupy and maintain a solid place on the market, assuring continuous activity, sustainable development and success. Industry is an indispensable ingredient in the development of a country. In the present study we focused on the ceramic sector, which represents an important part of the manufacturing industry. Several studies and PhD thesis can be found on the ceramic industry of Romania, in which our country's ceramic industry is compared to other European countries' ceramic industry. It is known that from the European countries Romania has been one of the slowest in embracing political and economic changes of the market economy Macquaid, 2001. The aim was to evaluate the development of an enterprise activating in this domain in Romania. This study is a novelty, because this we couldn't find any similar studies and results. In the case of all four performance criterion (competitiveness, flexibility, adaptability and reactivity) we selected multiple indicators. Some of these performance indicators were analyzed with multiple regression analysis, at Chemi Ceramic F Ltd., which is a company that produces technical ceramic products. As the theme chosen for the PhD thesis consists in a research regarding the Romanian ceramic sector's performance growth, we have chosen the above mentioned company, which is the only enterprise in Covasna county that accepted to collaborate with us in this matter.

## 2. Methodology

The research methodology is based on statistical analysis, which in this paper includes the multiple regression analysis. This type of analysis is used for modeling and analyzing several variables. The multiple regression analysis extends regression analysis Titan et al., by describing the relationship between a dependent variable and several independent variables Constantin, 2006. It studies the simultaneous emotions that some independent variables have over one dependent variable Lefter, 2004, and it can be used for predicting and forecasting. The multiple regression model can be much more realistic than the uni-factorial regression model Goschin and Vatui, 2002.

In our study the dependent variable consists in the size of the profit, while the independent variables are the following: self-financing capacity, return on equity, degree of technical endowment, personnel cost per employee and investment per person employed. All of these variables were monitored throughout ten years.

First we presented the necessary data for the analysis, after which we obtained the regression equation. We calculated the coefficient of determination  $R^2$ , which had the aim of indicating the percent of how much of the total variance is explained by the independent variables. Than we turned to F test and to Student test, respectively t with  $n-(k+1)$  degrees of freedom, in order to see which hypothesis can be accepted.

## 3. Multiple regression analysis

The main purpose of this analysis is to know to what extent is the profit size influenced by the five independent variables and what are those measures that should be taken based on the results obtained with using SPSS - Statistical Package for Social Sciences [C. Constantin, 2006]. The table below provides us the data needed to perform the multiple regression analysis.

Table 1. The evolution of the performance indicators at Chemi Ceramic F Ltd. between 2002 and 2011

|      | Size of the profit<br>(RON) | Self-financing capacity<br>(RON) | Degree of technical endowment<br>(RON) | Return on equity (%) | Personnel cost per employee<br>(RON) | Investment per person employed<br>(RON) |
|------|-----------------------------|----------------------------------|--|----------------------|--------------------------------------|---|
| 2002 | 704                         | 350                              | 664.13                                 | 9.10                 | 2338.00                              | 175                                     |
| 2003 | 79515                       | 80742                            | 8009.29                                | 441.70               | 4494.57                              | 250                                     |

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