

The analysis of the influence factors affecting the performance of pharmaceutical companies

Dana-Maria BOLDEANU

Bucharest University of Economic Studies, Romania
boldeanud@cig.ase.ro

Irina-Bogdana PUGNA

Bucharest University of Economic Studies, Romania
irina.pugna@cig.ase.ro

Abstract. *The paper provides an overview of current situation of the global pharmaceutical industry, with focus placed on the EU pharmaceutical market, including also the Romanian pharmaceutical market evolution synthetized into a SWOT analysis. As main goal the paper identifies several financial performance influence factors at the level of a number of companies from pharmaceutical sector, in order to generate a particular econometric model. The findings of the paper focus on the prediction of Return on Equity (ROE) ratio as the main performance measurement considered significant for the industry our and a large number of factors which contribute to its changes. Thereof, the paper investigates the relationship between various influence indicators or factors resulting from the financial situation of a company and the performance thereof and generates conclusions for the decisions makers at the level of the companies.*

Keywords: economic and financial performance, financial ratios, pharmaceutical industry, quantitative analysis.

JEL Classification: L25, C01, C10, C51, C87, L19.

REL Classification: 17G.

Introduction

The analysis of the economic and financial performances is a frequently debated matter in the economic media from the last decades, covering a very large spectrum, comprising various meanings and tendencies which will continuously capture the interest of the economists, the accountants and the IT specialists. A firm's performance measurement has been the subject matter of discussion for decision makers as managers, planners, economists and academic staff since long many years.

The present study attempts to examine financial performance at the level of EU pharmaceutical industry, to identify its strengths and weaknesses. Also one of the papers' objectives is to analyze how financial performance is achieved by the companies from this industry and to identify the main influence factors. To achieve this purpose we intend to develop an econometric model to empirically investigate the relationship between various influence indicators or factors resulting from the financial situation of a company and the performance thereof.

The study is based on both primary and secondary data. The collected data have been tabulated, analyzed and interpreted on the basis of different financial ratios using statistical tools. Pharmaceutical sector proves in the last years an extremely large openness on the single European market. To provide international visibility of the research results we intend to shape the level of openness of the single European market providing an overview of the financial performance at microeconomic level applied to the Pharmaceutical sector.

In this global market competition we will focus on the basis of the supply chain in this area, i.e. the performance of the producers of the pharmaceutical substances.

The structure of the paper is as follows. *The first chapter* deals with an overview of current situation of the global pharmaceutical industry, with focus placed on the EU pharmaceutical market evolution. *The second chapter* includes a literature review on economic performance of the pharmaceutical level applied at EU level. In the *third chapter* we have detailed the econometric modeling of the economic and financial performances presenting the relationship between performance's influence factors seen as independent variables. In *Chapter 4*, we have presented the research methodology with hypothesis, data sources and the usage of variables. At the end of the chapter, we provide the empirical results with their interpretation. In the last section, *Discussions and conclusions*, we intend to provide some final remarks, limitations of the thesis and future research actions.

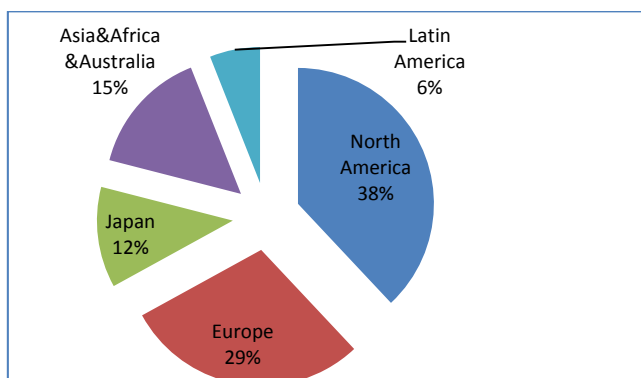
1. Overview on global pharmaceutical industry

According to SESRIC (2011) the global pharmaceutical industry has proved a rapid growth over the years and emerged as one of the fastest growing industries in the world. However, world pharmaceutical production and consumption is still unevenly dispersed around the world with the developed countries as the leading producers and consumers of pharmaceuticals.

IMS Health (2010) stated that world pharmaceutical market was valued at US\$ 875 billion with a growth rate of 4.1% over the previous year at the constant exchange rate. The volume of pharmaceutical industry has surged from USD 647 billion in 2005 to USD 875 billion in 2010, corresponding to an increase of 35.2%. During this period, the industry's growth rate has witnessed a declining trend from 7.2% in 2005 to 4.1% in 2010. This decline is mainly associated with the slowdown in economic activity, especially in the developed countries which consume a large quantity of global pharmaceutical products. In 2008, economic slowdown in developed countries culminated into one of the worst global financial and economic crisis since the Great Depression. The negative effects were felt across the globe and the pharmaceutical sector experienced the same situation. However, in 2009, the negative effects of the crisis subsided and global economy has started to recover.

Both in terms of production and consumption, global pharmaceutical market is highly concentrated in the developed regions like North America (38%), Europe (29%) and Japan (12%) which in 2010 accounted for nearly 80% of global market. Developing regions like Asia, Africa, Australia and Latin America with a share of nearly 85% of world population are accounted for only 21% of global pharmaceutical consumption in 2010 (Figure 11). A breakdown of pharmaceutical market in developing world reveals that Asia, Australia and Africa represent nearly 15% whereas Latin America accounts for 6% of the global pharmaceutical market.

Figure 1. *Regional Distribution of Global Pharmaceutical Market*



Source: IMS Health Market Prognosis, March 2011.

IMS Health Midas provides an update of Top 10 Global Corporations in pharmaceutical industry also for the Romanian market as important players in the import of pharmaceutical products. Moreover, some of them have also production facilities (i.e. Sanofi-Aventis). The tendency expressed by several experts in the area was that pharmaceutical companies will face significant operating challenges during 2011, as the expiration of significant drug patents is set to erase record levels of revenues and earnings, coupled with pressure from government cost containment in the US and Europe. Also the governments were cutting healthcare costs across the board, ensuring that pharmaceutical companies face the prospect of much lower prices and higher reimbursement restrictions. The predictions for 2013 are similar with the one for 2012 and 2011 having in mind that fact that pharmaceutical companies are struggling to develop promising new therapies against a backdrop of global austerity and healthcare reform.

Pharmaceutical industry, like IT industry, relies heavily on research and development (R&D) activities. Hence proper R&D facilities should be built and researchers and technicians should be provided with necessary financial resources to develop an innovative pharmaceutical industry in the competitive economies.

Besides economies of scale in manufacturing, clinical trials and marketing, bigger companies can allow investments in more research and development (R&D) projects that diversify their future drugs portfolio and make them much more stable in the long term. As the result, top-companies in the industry were active participants of mergers and acquisitions (M&A), new joint ventures and spin-offs of non-core businesses. This M&A activity can be seen also in the Romanian market, as we will present later on.

As clarification, generics drugs are usually produced by a manufacturer who is not the inventor of the original product, and are marketed when intellectual property protection rights are exhausted. Original drugs, the branded ones, are those which revolutionize a certain market segment when they are launched, opening a new therapeutic area or providing a new treatment for a disease. The EU Pharmaceutical Legislation adopted in 2004 has created a harmonized EU eight-year data exclusivity provision with an additional two-year market exclusivity provision to which the drugs are protected by patents and licenses.

Global pharmaceutical companies are trying hard to stave off the R&D crisis through mergers and acquisitions, geographic expansion and diversification into new areas such as consumer health. As a consequence, according to an article in Seeking Alpha (2011), Fitch Ratings anticipated that pharmaceutical companies will face significant operating challenges during 2011, as the expiration of significant drug patents is set to erase record levels of revenues and earnings,

coupled with pressure from government cost containment in the US and Europe. In this regard, the agency outlook for the sector in 2011 was negative.

R&D is costly but if successful, it pays off. The market for pharmaceutical products is global and most (western) countries spend a large share of their income on health (around 6 to 10%). The national budgets that are spent on pharmaceuticals range from around 1% to 2% of GDP. On average, European countries spend around 1.5% of their income on pharmaceuticals according to ECORYS (2009).

According to EUROSTAT data, the pharmaceutical industry is the high technology sector with the highest value-added per person employed, well ahead of the average value for high-tech and manufacturing industries. The pharmaceutical industry is also the sector with the highest ratio of R&D investment to net sales. It amounts to approximately 3.5% of total EU manufacturing value added and 18.9% of the total worldwide business R&D expenditure. In 2007 the Romanian pharmaceutical production reached 280 million USD (EFPIA, 2009).

In 2010 the research based pharmaceutical industry invested an estimated 27.000 million USD in R&D in Europe. Romania carried out R&D in amount of approximately 150 million USD in 2009 according to EFPIA member associations (2009).

After a decade of strong US market dominance, which led to a significant shift of economic and pharmaceutical research activity towards the US during the period 1995-2005, Europe is now also facing increasing competition from emerging economies. For 2011-2012 China, India and Brazil are predicted to be the fastest growing regions among developing countries for the pharmaceutical industry according to *Global Pharmaceutical Industry Outlook Survey*.

According to Kiran and Mishran (2009) India now ranks 3rd worldwide in volume and 13th in value and exporting to more than 200 countries around the globe including the highly regulated markets of US, Europe, Japan and Australia.

In the same time, several studies show that China is predicted to be the second largest pharmaceutical market after the United States by 2015. Due to the evolution of the markets, within the next decade, Asia is expected to overtake Europe in pharmaceutical sales, driven by growth in key emerging markets.

Owing to their rapid growth, most of the important pharmaceutical companies are focusing on the emerging markets of Brazil, Russia, India, China, Mexico, and Turkey (BRIC-MT) to increase global and regional drug sales.

In 2007, according to CBI market survey (2010) Romania was the 16th largest pharmaceutical producer in the EU, accounting for over 0.2% of total EU production. The largest producer in the EU in 2007 was France, which accounted for 21% of the total production. Between 2005 and 2007, Romanian production increased by an annual average rate of 24%, amounting to 280 million euro in the latter year. The increase in Romanian production was well above the EU average of 3.5% during that same period and represents one of the highest growth rates in the EU.

There are approximately 300 manufacturers, importers and distributors of drugs on the Romanian market. In recent years, a number of overseas generic companies have entered the Romanian market, increasing the range of products available in the country, providing access to new export markets and improving sales performances. A number of acquisitions have taken place, including that of Sicomed in September 2005, by the leading Czech company Zentiva, now a member of Sanofi-Avensis group one of the most important companies from Central and Eastern Europe (CEE). In March 2006, India's largest generics manufacturer, Ranbaxy, acquired Terapia Cluj. In the same month, the Icelandic generics manufacturer, Actavis, acquired the generics company specialized in oncology products, Sindan.

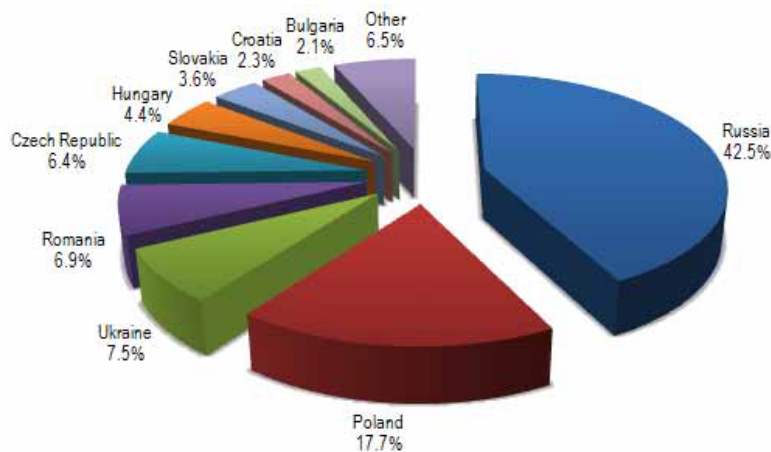
The Romanian Association of International Drug Producers has 26 members including Amgen, AstraZeneca, Bayer, Bristol-Myers Squibb, GlaxoSmithKline, Johnson & Johnson, Merck, Sharp & Dohme, Novartis, Pfizer, Sanofi-Aventis and Servier. First place as market share we can place Sanofi (including Zentiva) with 8.3%.

It is important to note that in Romania generic drugs represent around 70% of the market in volume terms and 30% in value terms. Romania's pharmaceutical production is strongly focused on generic medicines. Romania produces also original drugs (for cancer treatment i.e. Antibiotice Iași).

Ministry of Health research institutes or medical universities, located in large cities such as Bucharest, Iasi, Cluj, Târgu-Mureș and Timișoara are carrying out the majority of R&D activities. Local companies also invest in R&D, such as Antibiotice Iași, which is continuously developing new central nervous system, cardiovascular, musculoskeletal and dermatology drugs. Even if development of the Romanian biotechnology industry has been slow with little funding available for research, but under the 2007-2013 National Plan for R&D and Innovation, more emphasis has been placed on the promotion of high quality research considering the fact that Romania has an educated workforce with experience in biology, pharmacy and biochemistry.

Espicom (2012) issued a report on the Romania World Pharmaceutical Market in which is pointed the Romanian market for pharmaceuticals was estimated at US\$4,467 million, or US\$208 per capita. This market size is comparable to Hungary; in per capita terms, the market is similar to Bulgaria. The market was expected to expand at a CAGR (compound annual growth rate) of 10.0% in Romania over the next few years, reaching US\$7,188 million by 2016, equal to US\$337 per capita. The growth rate may be affected by slow economic recovery, however. Whilst the large population creates demand for pharmaceuticals, the low GDP per capita means that patients are unlikely to be able to afford the most expensive drugs and will settle for the cheaper alternatives.

Figure 2. Regional Comparison of Projected Pharmaceutical Market Share at Retail Prices, 2016



Source: Romania World Pharmaceutical Market 2012 after Espicom.

Pharmaceutical companies listed at Bucharest Stock Exchange are Antibiotice Iasi (ATB), Zentiva (SCD) si Biofarm (BIO) and Farmaceutica Remedia (RMAH). The primary growth drivers of the three companies listed at the stock market are their generic drugs division, which gives them an upper hand from international groups. Farmaceutica Remedia S.A. operates a chain of pharmacies in several cities from Romania. The company offers marketing and distribution services for the public and private pharmaceutical health system and the pharmaceutical market.

As a consequence of all financial information known regarding the evolution of the Romanian pharmaceutical market we can create a SWOT analysis table with the most important aspects taken into consideration.

Table 1. *SWOT analysis on Romanian pharmaceutical market*

<p>Strengths</p> <ul style="list-style-type: none"> ▪ Romania produces original drugs ▪ Relatively cheap labor force makes Romania a potential threat to suppliers in developing countries. 	<p>Weaknesses</p> <ul style="list-style-type: none"> ▪ Romania is focused on the production of generic medicine. ▪ Romania is one of the smallest exporters of pharmaceutical products in the EU. ▪ Whilst the large population creates demand for pharmaceuticals, the low GDP per capita means that patients are unlikely to be able to afford the most expensive drugs and will settle for the cheaper alternatives.
<p>Opportunities</p> <ul style="list-style-type: none"> ▪ Generic medicines dominate the Romanian market, which points toward positive prospects for exporters in developing countries. ▪ Romania will be the fourth largest pharmaceutical market in Central & Eastern Europe in 2016 	<p>Threats</p> <ul style="list-style-type: none"> ▪ Romania imports from developing countries, main imports being heavily dominated by two main countries, India and Egypt. ▪ The economic crisis is affecting the consumption of pharmaceutical products in the country, especially regarding non-prescription products.

2. Literature review on economic performance

The problematic of “performance” is a constant of the present economic turmoil, but also an insufficiently explored one. The “performance” of an organization has a complex character and reflects a concrete image over the financial and economic situation of an analyzed company. Recent studies on this issue brought to the specialists’ attention the necessity of identifying an intelligent and performing information system in order to support the decision makers in the strategic management process.

While “performance” has been present in the economic and financial literature since 1960 being formulated through different criteria, both quantitative and qualitative, there is no concrete definition of the concept. Performance has evolved from 1990, in terms of necessities and requests, several definitions being established on the reason of the level of achievement of organizational objectives (Bourguignon, 1995), to a positive result of an action or success in a specific area as Niculescu (2005) pointed out, to the multidimensional goal or purpose of the activity as a reflection of an enterprise’s multiple goals (Jianu, 2007)

The performance of an organization remains a central challenge for management research. In many diagnosis analyses, built around the main object of activity, there are direct links to items of financial performance. However, comparative economic data are not always available and they are subjective during a performance assessment. Due to these considerations, a greater attention has been given in the last years to the financial performance which generated a big impact over the performance management system.

Majumder and Rahman (2011) advanced the idea that financial statements contain a wealth of information which, if properly analyzed and interpreted, can provide valuable insights into a firm's performance and position on the market. Several studies that approach the performance issue at the microeconomic level prove the special importance of financial management aspects, on the improvement of which depend the outcomes and the companies' competitiveness (Burja, 2011).

What interests us in a particular way, taking into account the specific of economic activity is the financial performance, through which we understand the capacity of a firm to generate new resources from day to day operations in a certain period of time.

Information regarding performance represents evidence about financial performance that are collected and systematically used. Evidence may relate to efficacy or effectiveness of activities in this case talking about outcomes, factors that may affect the results and measures that can be taken to improve financial performance. As I mentioned in a previous study the performance aimed real information translated into terms of performance indicators (Boldeanu, 2008).

Performance can be measured through several indicators or financial ratios. So far the literature has analyzed the performance of companies from various countries and economy sectors through different accounting – based measures with great impact including return on assets (ROA), return on equity (ROE) and gross profit margin (GPM) (Abu-Rub, 2011), net operating profitability (NOP) (Raheman et al., 2010), return on total assets (ROTA) (Deloof, 2003), return on invested capital (ROIC), return on assets (ROA) (Narware, 2010). Performance at microeconomic level has been studied depending also on liquidity such as current ratio and liquid ratio (Singh et al., 2008), risks factors identified through leverage (Weill, 2011) and cash flow per liabilities. Other researches highlight performance assessment expressed by earnings before interests and taxes (EBIT) or expressing it though economic value added (EVA), return on equity (ROE), operating profit margin (OPM) (Ryan, 2008).

Rees (1995) pointed out that in the financial analysis, the wide use of financial ratios is an answer to the high amount of data contained in a set of financial statements and to the issue of comparing companies of different sizes. Financial ratios may be used individually or in groups, in order to compare companies among themselves or against industry benchmarks. In most cases, the result of such analyses depends to a high extent on the financial analyst's skills and expertise.

A performance measure to determine the financial state of a company should not be sensitive to the choices of accounting methods and procedures, but it must assess the current management decisions, the risks of investment decisions and

not punish managers for circumstances that are beyond their control (Damodaran, 2002). Under these circumstances a better choice could be EVA or any other performance measure that would consider “adding” value through previous investments. Nevertheless, Han et al. (1999) concluded that ROE is often used in econometric analyses with financial data.

3. Econometric modeling of financial performance

Modeling economic performance aims to increase efficiency by improving interventions in an adaptive learning cycle (Campbell et al., 2001). The information rising from sources both internal and external to the company, the processing of this information, the obtaining of financial statements and determination of the representative indicators apt to illustrate the real status of the factors which influence the performance of the company and the wide range of potential users (investors, managers, employees, clients, banking institutions, state authorities etc.), all of these bring into light various systems for assisting the decision in an informational environment, with favorable results for all the actors involved in this process.

Within the economic-financial analysis, there is a series of models, methods and procedures which are either specific or borrowed from other sciences. At present there are several basic methods and procedures designed for the diagnosis analysis of a company and for setting its financial-economic performances. Such methods help to set up a direct link between the identified economic performances and the overall strategy of the company (Boldeanu, 2008).

The mathematical-economic methods which use the various financial ratios proved their usefulness in the decision-making process of capital investors. Most of the time, these models involve linear relations between a set of financial ratios and the company return ratio.

As a dependent variable used, we employed ROE, as we believed that it synthesizes best the concept of company performance if it is to synthesize it by means of one indicator only. Return on Equity is perhaps the most commonly used profitability measure (Bertoneche et al., 2001). Due to the data accessibility and the ease in being understood, as well as to the interest granted to this ratio by capital investors, we decided to apply ROE instead of EVA (Economic Value Added) in generating an econometric model to empirically investigate the relation between various ratios from the financial situation of a company and the performance thereof.

As to the company’s specific factors, in our case ratios, included as independent variables, we decided to group them into four major categories:

Growth dynamics factors:

- **EBITDA or EBIT Margin** – EBITDA margin is calculated as EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) divided by Total Sales and EBIT Margin as EBIT (Earnings Before Interest and Taxes) divided by total revenue.
- **Net Profit Margin** – the ratio reveals the overall profitability of the concern, that's why it is very useful to the owners and prospective investors. It also indicates management efficiency in manufacturing, managing and selling of the products.
- **Earnings per Share (EPS)** – it is an important financial performance measure. Together with other ratios, EPS can provide insightful information on a firm's growth and financial condition.

Liquidity factors:

- **Current Ratio** – Going further than the usually employed models which are supposing linear relations in only one sense, between ROE and various factors of financial ratios type, we will propose testing the hypothesis regarding the existence of non-linear relations between the financial ratios and ROE specific to various industries. According to Mramor and Mramor-Kosta ROE should rise fairly quickly, with the positive evolution of liquidity from zero until at some level of liquidity reaches a maximum level of ROE. ROE beyond that level starts to decrease slightly as the current liquidity continues to grow. Companies with low liquidity problems are estimated to meet its short term obligations, problems which have a negative impact on the rate of return. Once reached the optimum level of liquidity ratio, additional liquidity costs outweigh the benefits and the rate of return fades. In this case the function is estimated to have a quadratic form of logarithmic type as described before. (Mramor et al., 1997).
- **Quick Ratio** (immediate liquidity) - Evolution of ROE based on immediate liquidity and current liquidity is similar, with the observation of faster growth and achieving the maximum faster in case of the immediate liquidity.

Risk factor:

- **Leverage under the expression of Debt to Total Assets (DTTA)** - Financial structure leverage or simply leverage, calculated as ratio between debt and total assets (the version used in our model) or the ratio between liabilities and total assets. Financial structure leverage measures how the company's total assets are financed by debt or equity.

Company Size Factors:

- **Book value (BV)** – A company's common stock equity as it appears on a balance sheet, equal to total assets minus liabilities, preferred stock, and intangible assets such as goodwill.

Furthermore, besides the specific company factors, in a future more detailed analysis we might also consider some effects related to the company country of origin (Inflation GDP deflator, GNI/capita, health expenses/GDP), as assessment through experimental analysis of their impact.

We do not claim that the list of the variables above is exhaustive. ROE may also be influenced by other factors besides the ones already specified, which we will gather in a stochastic variable called error by obtaining a classic regression equation.

We can also employ dummies variables as independent variables. A dummy variable is a number variable used for econometric regressions to represent subsets of the data set. The simplest case, dummy is a variable with two values, 0 and 1, where to a record in the data set we are assigning the value 1 it means it belongs to the group taken into consideration. Dummy variables are useful because they allow the use of a single equation to represent multiple different groups, and can focus the characteristic effect of each group factors, which are not specified individually in the model.

In this case, considering the fact that we have mentioned in the first chapter the difference between generic and original drugs and the evolution of the pharmaceutical industry in the CEE countries we will use two dummy variables:

- **Country origin (CO)** (we are interested only in Romanian companies from our panel set of data). Romanian companies will be assigned with value 1, all the others with value 0.
- **Types of drugs (TD)** produced by the companies (the original drugs protected by patents and licenses will be assigned with 1 and the generic producers with 0).

The initial function of the model will have the following structure:

Figure 3. *Initial structure of regression function*

$$\text{ROE} = \beta_1 + \beta_2 * \text{EBIT Margin} + \beta_3 * \text{Earning per Share (EPS)} + \beta_4 * \text{Net Profit Margin} + \beta_5 * \text{Current Ratio} + \beta_6 * \text{Quick Ratio} + \beta_7 * \text{Debt to Total Assets (DTTA)} + \beta_8 * \text{BookValue(BV)} + \beta_9 * \text{CompanyOrigin (CO)} + \beta_{10} * \text{Drug Type (DT)}$$

4. The research methodology

Data source, methodology and usage of variables

The model aimed to be provided can help the decision maker to obtain a qualified answer to at least the following issues:

- Which are the factors that positively or negatively influence ROE and which is their degree of influence?

- Which are the other factors that influence the company performance and that may be considered in order to improve the model?

Having as starting point the research questions considered in our case as hypotheses, we shall continue with the research methodology based on a quantitative analysis focused on the explanation or prediction of the Return on Equity (ROE), using all available data within the company and the relation between various financial indicators/ratios resulting from the financial situation of a company.

In this case we have used a total number of 23 companies on a period of three years from 2010 to 2012 from the pharmaceutical sector from CEE, based on an ordinary regression of the type of the least squares method (OLS). The most frequently used method for this type of analysis is multiple regression, a method we will also use but with a few elements, let's call them experimental, as a variation from the traditional regressions.

The data set refers to the financial statements obtained through access to the online database ISI Emerging Markets (www.securities.com). We took into consideration only listed companies from 7 CEE countries (Bulgaria, Poland, Romania, Russia, Slovakia, Turkey and Ukraine) having as main activity object "*Pharmaceutical and Medicine Manufacturing*".

In this research paper we have used SPSS program in order to get the regression results. Data cleaning was a process which helped us to keep only accurate data for the panel analysis.

According to Mramor and Marmor-Kosta (1997), ROE should grow fairly quickly, with the positive evolution of liquidity from zero, up until a certain level of liquidity to achieve a maximum ROE, while ROE beyond that point starts to decrease slightly as the current liquidity continues to grow. Companies with low levels of liquidity are expected to have problems to fulfill their obligations in the short term, problems that have a negative impact on the rate of return. Once reached the optimal level of liquidity ratio, additional liquidity costs are greater than benefits and the rate of return begins to decrease. And in this case the function is estimated to have a quadratic logarithmic type:

$$y = a + b_1 * \ln x + b_2 * \ln^2 x$$

Such a function has the following features (assuming appropriate values assigned coefficients) when the variable x increases, the values of y function first increase rapidly, then reach a maximum after which they begin to decline slowly. The disadvantage of such function is that their parameters cannot get a simple economic and easy to understand explanation.

According to Mramor and Marmor-Kosta (1977), the relationship between ROE and ROA (Return of Assets) should be increasing, either as linear or quadratic form (grade 2) due to financial leverage. We will consider increasing linear relationship as leverage in the model is analyzed separately by specific factors. ROA is a factor often used in econometric models, mentioning here the works of Chen (2004) and Cronqvist et al. (2003).

Similar with the case of ROA in accordance with the same authors mentioned above, the effect is linear and increasing or, due to the leverage total effect, increasing quadratic - we will consider EBIT Margin by the same argument as linear.

Following the previous reasoning we are going to use the independent variables as follows: $\ln(\text{CurrentRatio})$, $\ln^2(\text{CurrentRatio})$, $\ln(\text{Quick Ratio})$, $\ln^2(\text{Quick Ratio})$, $\ln(\text{DTTA})$, $\ln^2(\text{DTTA})$. Considering these aspects, the regression formula will have the following structure:

Figure 4. *Logarithmic and quadric logarithmic structure of the model*

$$\begin{aligned} \text{ROE} = & \beta_1 + \beta_2 * \text{EBIT Margin} + \beta_3 * \text{EPS} + \beta_4 * \text{Net Profit Margin} + \beta_5 * \ln(\text{Current Ratio}) \\ & + \beta_6 * \ln^2(\text{Current Ratio}) + \beta_7 * \ln(\text{Quick Ratio}) \\ & + \beta_8 * \ln^2(\text{Quick Ratio}) + \beta_9 * \ln(\text{DTTA}) + \beta_{10} \\ & * \ln^2(\text{DTTA}) + \beta_{11} * \ln(\text{BV}) + \beta_{12} * \text{CO} + \beta_{13} * \text{DT} \end{aligned}$$

We considered in our regression model the natural logarithm of book value. Natural logarithm is used to reduce the proportion of scale and high values of indicators used in the literature by many researchers, as Himmelberg et al. were pointing out in their paper (1999). Bigger the company, greater the synergies and scale economies and ROE is expected to grow.

The econometric model is interesting through the large number of factors which contribute to the changes of the ROE indicators and helps us to identify and validate the main, essential factors, in our opinion and the one of other specialists mentioned all along the paperwork, factors which determine the financial and economic performances of the company.

Using these variables in the regression model we will obtain an R^2 of 0,795 and adjusted R^2 of 0,750 meaning that the model is significant with an F-statistic of 18,042. Still there are several variables which are not significant at all, like i.e. the 2 dummies used to express the specificities of the industry and the importance of a country in the whole panel data (i.e. Romanian companies). As a result for this implementation, the dependent variable, in our case ROE is explained 79% through the 12 variables from the model. The number of used variables is interesting, nevertheless considering the reduce data set and the fact that some variables are not significant and that Durbin Watson is only 1,209 we will reconsider the model.

Table 2 Regression between ROE & Independent Variables

No.	Predictors	Coefficients	Std. Error	t- student	Sig	VIF
1.	Constant	17,159	69,164	0,248	0,805	
2.	ln (BV)	-0,398	0,583	-0,683	0,495	1,728
3.	Net Profit Margin	0,313	0,036	8,790	0,000	1,541
4.	DC	1,440	2,801	0,514	0,609	1,623
5.	DT	0,902	2,008	0,449	0,655	1,668
6.	EBIT Margin	0,033	0,017	1,907	0,062	2,064
7.	ln(DTTA)	1,907	2,027	0,941	0,351	6,177
8.	ln ² (DTTA)	-0,966	0,565	-1,710	0,093	7,943
9.	ln(CR)	61,647	53,534	1,152	0,254	2,173
10.	ln ² (CR)	-5,566	5,027	-1,107	0,271	2,571
11.	ln(QR)	-60,638	36,268	-1,672	0,100	1,338
12.	ln ² (QR)	5,339	3,702	1,442	0,155	1,671
13.	EPS	0,530	0,105	5,027	0,000	1,434
Number of Observations			69			
R ²			0,795			
R ² adjusted			0,750			
Durbin Watson			1,209			
F			18,042			
Sig			0,000			

Having in mind the fact that correlation between variables (Annex 1) Net Profit Margin and ROE is 0,783 we can reconsider the model through eliminating this variable and also the dummy variables (Country origin and Drug Type). In this case we will obtain the following model:

Figure 5. Simplified structure of the regression model

$$\text{ROE} = \beta_1 + \beta_2 * \text{EBIT Margin} + \beta_3 * \text{EPS} + \beta_4 * \ln(\text{Current Ratio}) + \beta_5 * \ln^2(\text{Current Ratio}) \\ + \beta_6 * \ln(\text{Quick Ratio}) + \beta_7 * \ln^2(\text{Quick Ratio}) + \beta_8 * \ln(\text{DTTA}) + \beta_9 \\ * \ln^2(\text{DTTA}) + \beta_{10} * \ln(\text{BV})$$

In this situation the results of the regression model indicates that the dependent variable, in our case ROE is explained 50% through the 9 variables from the model. We can notice that the model is statistically significant by F-statistic value (6,566) and the associated probability Adjusted value of R² and R² are at an satisfying level for the given set of data (Adjusted R Square 42,42%).

Table 3 Regression between ROE & Independent Variables in the second proposed model

No.	Predictors	Coefficients	Std. Error	t- student	Sig	VIF
1.	Constant	-81,289	90,779	-0,895	0,374	
2.	ln(BV)	-0,843	0,840	-1,003	0,320	1.256
3.	EBIT Margin (%)	0,093	0,023	4,100	0,000	1.533
4.	ln(DTTA)	3,505	3,051	1,149	0,255	7.678
5.	ln ² (DTTA)	-1,817	0,844	-2,154	0,035	1.621E3
6.	ln(CR)	163,109	70,229	2,323	0,024	1.899E3
7.	ln ² (CR)	-14,892	6,563	-2,269	0,027	1.092E3

No.	Predictors	Coefficients	Std. Error	t- student	Sig	VIF
8.	Ln(QR)	-126,403	49,773	-2,540	0,014	1.318E3
9.	ln ² (QR)	11,930	4,993	2,389	0,020	6.061
10.	EPS	0,561	0,150	3,740	0,000	1.555
Number of Observations				69		
R ²				0,5004		
R ² adjusted				0,4242		
Durbin Watson				1,382		
F				6,566		
Sig				0,000		

Figure 6. *The regression equation*

$$\begin{aligned} \text{ROE} = & -81,289 + 0,093 * \text{EBIT Margin} + 0,561 * \text{EPS} + 163,109 * \ln(\text{Current Ratio}) \\ & - 14,892 * \ln^2(\text{Current Ratio}) - 126,403 * \ln(\text{Quick Ratio}) \\ & + 11,930 * \ln^2(\text{Quick Ratio}) - 3,505 * \ln(\text{DTTA}) - 1,817 \\ & * \ln^2(\text{DTTA}) - 0,843 * \ln(\text{BV}) \end{aligned}$$

Durbin Watson statistics is 1.382 not so close to the value of 2, which is the level that normally indicates no autocorrelation. There is an issue with the correlation of errors.

As a result of applying Stepwise method regression we have derived another model, a simplified formula of the regression function. We will employ in this model all the variables presented before. As a consequence of the method, from the initial model we can state that the main influence factors over firm's financial performance expressed through ROE are the following:

- **EarningPerShare (EPS)**
- **Net Profit Margin**

Table 4 *Regression between ROE & Independent Variables in the simplified model*

No.	Predictors	Coefficients	Std. Error	t- student	Sig	VIF
1.	Constant	5,908	0,860	6,873	.000	
2.	EPS	0,488	0,032	10,683	.000	1.048
3.	Net Profit Margin	0,337	0,097	5,042	.000	1.048
Number of Observations				69		
R ²				0,849		
R ² adjusted				0,721		
Durbin Watson				1,113		
F				85,109		
Sig				0,000		

The regression equation obtained in the end reflects the relationship between the return rate ROE and factors belonging to the efficiency and the growth dynamic.

Figure 7. *Simplified formula for the regression equation*

$$\text{ROE} = 5,908 + 0,488 * \text{EPS} + 0,337 * \text{EBIT Margin}$$

There is no multicollinearity between independent variables. No VIF is greater than 10 and the average of VIF isn't much greater than 1.

Durbin Watson statistics is 1.113 not very close to value 2 (which it is the right indication for no autocorrelation). There is an issue with the correlation of errors. For d statistics calculated for 69 observations and 2 variables, this means that we have evidence for $\alpha = 0.05$ indicating the rejection of the hypothesis regarding the absence of autocorrelation.

Empirical results of the regression analysis

The dependent variable, in our case for the second model taken into consideration (Figure 6) is explained in a proportion of 50% through the 9 variables from the model. We can notice that the model is statistically significant by F-statistic value and the associated probability Adjusted value of R^2 and R^2 are at a satisfying level of approximately 42.42%.

The probabilities attached to the coefficients for each variable assumptions allow the null hypothesis for $\alpha = 0.05$ level for six out of nine predictors). There is no predefined solution to develop a good model. A satisfactory result comes more from the application of econometric rules and from the high number of trials and the analyst's intuition regarding the factors to be added, the relationship type (linear, quadratic), the effects of the combined factors type (cross-factors, such as a regression of the $\beta_i \cdot \text{EBIT Margin} \cdot \text{Indebtedness degree}$ type).

In order to receive an answer to the question "What will be the ROE evolution in the next period and which are the factors that positively influence ROE and which is their degree of influence?", it is enough to set the trend of influence factors (EBIT Margin, Quick Ratio, Current Ratio, etc.), and then, based on the model, to obtain a future ROE evolution, taking into account, though, the error margin within the limit set for the model.

The explanation of factors can be provided by the complexity of economic phenomena associated with the company and the pharmaceutical industry, as follows:

- A company that has higher EBIT Margin is undoubtedly a company operating on the original pharmaceutical products segment, protected by patents and patents, and not the generics segment.

To support a leadership position in original medicines, such a company must invest significant sums in the costs of research and development (R & D) in the long run, to discover and develop new original recipes (after a period original medicines no longer are protected by patents and generic drugs), such payments in certain circumstances can lead to a decrease in ROE. Hence the idea that further analysis should include the costs R & D, either in absolute terms or as a ratio

of R & D/SG & A (general administrative expenses and selling) as suggested by Shin (2006) and should be considered as a factor in a future more elaborated model.

- Dummy variables for the company market (original or generic drugs) did not have any significance for the data set. On a larger data set this dummy, along with dummy linked to the country origin (markets on which are operating a large number of companies) might be relevant and significant.

Based on the comments above, we can add to these factors the R&D Expenses/Total SG&A Expenses, as well as a dummy variable for the manufacturing of original and not generic medicines.

For a data set with an increased number of observations and a frequency of several years and considering the dynamics of growth, we can use in a future model as independent variables the following:

- Assets growth ratio (assets one year growth calculated as a percentage of the assets given for a year divided by the value of the previous year and subtracting the value 1), due to the fact that it usually has a higher influence, proven that the pharmaceutical industry is a place where large players enjoy success, since they have the resources to support significant expenses for research and development
- Sales growth ratio (sales one year growth) calculated on the same manner, variable used in other similar model by Himmelberg et al. (1999).

The described model may be the object of decision making support application, may be used in analyses of the data mining type in order to identify significant clusters, decision making trees, pertinent associations among variables etc. These elements allow for a complex analysis of the economic-financial indicators that might lead to making strategic decisions for the improvement of economic-financial performances.

Discussions and conclusions

The importance of analyzing performance ratios, to make comparisons with the companies from the same field of activity, to detect new tendencies and to make profitable changes require the use of advanced specific tools for multidimensional analysis, equipment's performance, qualified personal for interpreting the analysis and the strengths to take important decisions for the prosperity of the company.

The classifications made in this study and the econometrical model can identify certain performance indicators useful for any financial and economic performance analysis of the companies. The regression model obtained in the paper reflects the relationship between the return rate ROE and principal influence factors belonging to the growth dynamic, as well as factors related to liquidity and risk. Other important factors such as R&D Expenses/Total SG&A Expenses or

Price/Book ratio might be involved in a future econometric model to observe more complex relationships.

Initially, we intended to develop the present regression analysis only on the Romanian pharmaceutical industry. Due to the limited number of Romanian companies in this area and the reduced time series, especially the listed ones, data collecting was proven to be a challenge for this research paper. Lack of information regarding pharmaceutical industry date was one of the big challenges of the paper. Collecting data for CEE companies on pharmaceutical sector for the years involved in research necessitates a lot of work concentrated on data finding and processing. As a limitation to this paper might be the limited size of the current sample, following the variables that might be taken into consideration, like country effects, but more important the R&D expenses.

A new tendency for a future research paper, using the current findings can be considered building a deterministic econometric model for determining the performance of Romanian pharmaceutical companies concentrated on the area of supply-chains, meaning here the whole set of producer –importer – distributor – retail (chain of pharmacies/independent pharmacies).

References

- Bertoneche, M., Knight, R. (2001). "Financial Performance Butterworth-Heinemann", *Oxford*
- Boldeanu, D. (2008). "Information system for the analysis and assessment of the economic and financial performances at microeconomic level", PhD thesis, *Bucharest Academy of Economic Studies*
- Bourguignon, A. (1995). "Peut-on définir la performance?", *Revue Française de Comptabilité*, 269:61-66
- Burja, C. (2011). "Factors Influencing The Companies' Profitability", *Annales Universitatis Apulensis Series Oeconomica*, 13(2)
- Campbell, B.M., Sayer, J.A., Frost, P., Vermeulen, S., Ruiz Perez, M., Cunningham, A.B., Prabhu, R. (2001). "Assessing the performance of natural resource system", *Conservation ecology*, vol. 5
- Chen, Y. (2004). "Essays on voting power, corporate governance and capital structure", *Kompendiet-Göteborg*
- Cronqvist, H., Nilsson, N. (2003). "Agency costs of controlling minority shareholder", *Journal of Financial and Quantitative Analysis* 38, no. 4
- Damodaran, A. (2002). *Investment valuation – tools and techniques for determining the value of any asset*, 2nd Edition, John Wiley & Sons Inc.
- Deloof M. (2003). "Does Working Capital Management Affect Profitability of Belgian Firms?", *Journal of Business&Accounting*, vol. 30, issue 3-4
- Han, K., Lee, S. and Suk, D. (1999). "Ownership structure and firm performance: international evidence." *Multinational Business Review*, 7, pp. 92-97
- Himmelberg, G., Hubbard, D. Palia (1999). "Understanding the determinants of managerial ownership and the link between ownership and performance" *Journal of Financial Economics* 53, pp. 353-384

- Jianu, I. (2007). *Evaluarea prezentarea și analiza performanței întreprinderii*, Editura CECCAR, București
- Kiran, R., Mishran, S. (2009). "Performance of the Indian Pharmaceutical Industry in Post-TRIPS Period: A Firm Level Analysis", *International Review of Business Research Papers*, Vol. 5 No. 6 November 2009, pp.148-160
- Majumder, T.H., Rahman, M.M. (2012). "Financial Analysis of Selected Pharmaceutical Companies in Bangladesh", *European Journal of Business and Management*
- Mramor, D., Marmor-Kosta, N. (1997). "Accounting Ratios as Factors of Rate of Return on Equity. New Operational Approaches for Financial Modeling", *Heidelberg: Physica-Verlag*, pp. 335-348.
- Narware, P.C. (2010). "Working Capital Management: The Effect of Market Valuation and Profitability in Malaysia", *International Journal of Business and Management*, vol. 5, issue 11
- Niculescu, M. (2005). *Diagnostic financiar*, vol II, Editura Economică, București, p. 42
- Raheman, A., Afza, T., Qayyum, A., Bodla, M.A. (2010). "Working Capital Management and Corporate Performance of Manufacturing Sector in Pakistan", *International Research Journal of Finance and Economics*, issue 47.
- Rees, B. (1995). *Financial Analysis*, London: Prentice Hall, second edition, available on-line at <http://www.onesource.com>
- Romania World Pharmaceutical Market Q1 2012 (2012). Espicom Business Intelligence, available online at www.researchandmarkets.com
- Ryan, K. (2008). "Financial leverage and firm value", *Gordon Institute of Business Science*, University of Protoria
- Saeedi, A., Mahmoodi, I. (2011). "Capital Structure and Firm Performance: Evidence from Iranian Companies", *International Research Journal of Finance and Economics*
- Shin, N. (2006). „The impact of information technology on the financial performance of diversified firms”, *Decision Support Systems*, no. 41.
- Singh, J. P., Pandey, S. (2008). "Impact of working Capital Management in the Profitability of Hindalco Industries Limited", *ICFAI University Journal of Financial Economics*, vol. 6(4), pp. 62-69
- Weill, L. (2011). "Leverage and Corporate Performance: A Frontier Efficiency Analysis", *12th Symposium on Finance, Banking, and Insurance, Karlsruhe Institute of Technology (KIT)*, Germany, available on-line at <http://www.fbv.kit.edu/symposium/>
- Ecorys (2009). "Ecorys report on competitiveness of EU market & industry for pharmaceuticals published by EC", available online at http://ec.europa.eu/enterprise/sectors/healthcare/competitiveness/monitoring/index_en.htm
- EFPIA (2009). *European Federation of Pharmaceutical Industries and Associations Annual Review*, available online at <http://www.efpia.eu/>
- Espicom (2012). The Pharmaceutical Market: Romania <http://www.marketresearch.com/Espicom-Healthcare-Intelligence-v1129>
- EU pharmaceutical Legislation (2004), available online at http://ec.europa.eu/health/documents/eudralex/vol-1/index_en.htm
- IMS Health Market Prognosis (2010), available online at <http://www.imshealth.com>
- News and Analysis, *Nature Reviews Drug Discovery* 9, 417-420 (June 2010). doi:10.1038/nrd3204, available online at <http://www.nature.com/nrd/journal/v9/n6/full/nrd3204.html>
- Seeking Alpha (2011). "Negative Outlook for Big Pharma in 2011 as Patents Expire", available online at <http://seekingalpha.com/article/247109-negative-outlook-for-big-pharma-in-2011-as-patents-expire>
- SESRI (2011). "Pharmaceutical industry production, consumption and trade", available online at <http://www.sesric.org/files/article/433.pdf>