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Market Capitalization Modeling of Petrochemical Enterprises on the Basis of Multifactorial Regression Models

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ABSTRACT: Nowadays, the literature deals in detail with the analysis of the financial condition and the assessment of the company market value. However, the majority of authors consider these concepts separately, which does not allow making effective analytical decisions during the analysis of a company investment attractiveness. The article develops multifactor regression models that allow to obtain a quantitative assessment of closeness degree concerning the relationship between the indicators of company financial stability, profitability, turnover, liquidity and market value. The authors consider the company value as an integral indicator that can be used instead of an extensive set of financial ratios during the company financial position evaluation. Based on the econometric analysis of data from Russian petrochemical enterprises that meet the criteria of profitability, financial stability and maturity, the article draws conclusions about the possibility of practical application of the proposed models.

In order to develop an empirical base of research, the data were collected on annual accounting (financial) statements for Russian companies in the petrochemical industry [2, 5]. The time interval from 2013 to 2018 was chosen for the analysis. A balanced sample of 16 enterprises was compiled.

In order to perform in-depth analysis based on empirical data, we formulated and tested the following hypotheses.

Hypothesis 1: The market value of a company has a significant relationship with profitability indicators.

Hypothesis 2: Solvency indicators, which include current, intermediate and absolute liquidity ratios, have a positive effect on company capitalization.

Hypothesis 3: The market value of a company has a significant relationship with financial stability indicators.

Hypothesis 4: With turnover rate increase, the growth of the company capitalization is ensured.

Hypothesis 5: The market value of a company has a significant relationship with the economic value added.

Hypothesis 6. The market capitalization is influenced by external environment indicators such as the dollar rate, refinancing rate (the key rate since 2016), the price of Brent crude oil, the inflation rate and the industrial production index.

According to the results of the performed analysis, not all hypotheses were confirmed. So, the influence of external factors, as well as solvency and turnover indicators on the company value turned out to be insignificant.

Keywords: capitalization, regression, hypothesis, economic value added, financial sustainability.

I. INTRODUCTION

Just a few years ago, the majority of domestic economists chose profits that remain at the disposal of a company and can be reinvested in the development of society, or used to pay dividends as the criterion for a company performance. Today, the company value is becoming increasingly important, and the main purpose of the company existence is the maximization of the company value. The enterprises with high market value have the opportunity to make a significant impact on the market, to cope with crises in the economy and politics (for example, with sanctions), to introduce the latest achievements of scientific and technological progress in their activities. All this makes this topic relevant undoubtedly, since the modern Russian economy is in the post-crisis period, in which it is especially important to maintain high financial stability and independence.

II. METHOD

Market capitalization is a simple metric based on stock price. It is necessary to multiply the number of shares in circulation by the current price of one share to calculate the company market capitalization. In other words, this term means the total value of organization shares [12-14]. However, stock prices are very subjective in many cases [7]. The share price is not determined by any mathematical formula. Market value depends on many factors, such as the sector in which the company operates, its profitability, and debt load. This indicator also takes into account the opinion of investors [3].

The analysis of factors affecting the company market Russian petrochemical company research: data collection for the study; the calculation of financial ratios for each company; the selection of explanatory variables that affect financial sustainability to develop a multiple regression model; regression model development; evaluation of the results in terms of compliance with the theory of corporate governance.

In order to study the factors affecting the financial condition of companies, a multiple regression model was constructed in the study. The linear model of multiple regression has the following form [8]:

$$Y = a+b_1*x_1+b_2*x_2+\ldots+b_m*x_m+ \varepsilon \quad (1)$$

Regression analysis is aimed at indicator value prediction chosen as the dependent variable with the identification of the factors that have the greatest influence on it [11].

In order to perform in-depth analysis based on empirical data, we formulated and tested the following hypotheses.

Hypothesis 1: The market value of the company has a significant relationship with profitability indicators. Thus, with the growth of this group of indicators, the investment attractiveness of the company shares should increase, and, consequently, the market capitalization should also increase.

Hypothesis 2: Solvency ratios, which include current, intermediate and absolute liquidity ratios, have a positive effect on company capitalization.

Hypothesis 3: The market value of a company has a significant relationship with financial stability indicators.

capitalization by enterprises from the empirical base of

Hypothesis 4: With the growth of turnover indicators, the growth of the company capitalization is ensured.

Hypothesis 5: The market value of the company has a significant relationship with the economic value added. EVA is the difference between the company operating profit after taxation and the total cost of the company capital [6, 9].

Hypothesis 6: The market capitalization is influenced by external environment indicators such as the dollar rate, refinancing rate (the key rate since 2016), the price of Brent crude oil and the inflation rate and the industrial production index.

III. RESULTS

As they noted earlier, one of the key indicators characterizing the value of an organization is the characteristic of its market capitalization. Market capitalization is a relatively good way to evaluate a company quickly, since stock prices are usually based on investors' expectations of a company profits. The explanatory variables given in Table 1 were selected for the analysis.

They also checked the interrelation of market capitalization with external factors: X17-Dollar exchange rate (rub.); X18 - The price of Brent crude oil (dollars); X19 - Inflation rate (%); X20 - Refinancing rate (%); X21 - Industrial Production Index.

Some factors of the model were logarithmic due to correct regression estimate obtaining.

Table 1: Descriptive statistics (in 2013 - 2018 on the average).

Indicator		Description	Average by sector
Y	Market capitalization, mln. rub.	Number of shares outstanding, multiplied by the price of one share.	52 519,4
	Ln (Market Capitalization)	Natural logarithm of market capitalization.	15,89
X1	Intermediate liquidity ratio	The ratio of highly liquid current assets to current liabilities.	5,43
X2	Current liquidity ratio	The ratio of current assets to current liabilities.	5,31
X3	Ln (Net Assets) annual average	The difference between the sum of the company assets and its liabilities.	15,98
X4	Autonomy ratio	The ratio of equity to liability balance.	0,53
X5	Financial leverage effect (DFL)	The increment to the return on equity, obtained through a more profitable use of borrowed funds in comparison with their value [10].	0,04
X6	Financial stability ratio	The ratio of equity and long-term liabilities to the balance sheet.	0,73
X7	SOS provision ratio	The ratio of own working capital of the company to the value of current assets.	-0,81
X8	OA turnover ratio	The ratio of sales revenue to the average annual value of current assets.	3,05
X9	Inventory turnover ratio	The ratio of cost to the average annual value of stocks.	10,33
X10	DZ turnover ratio	The ratio of sales revenue to the average annual value of inventory.	8,50
X11	DZ turnover ratio	The ratio of cost to the average annual value of stocks.	6,75
X12	Return on sales	The ratio of profit from sales to sales revenue.	0,20
X13	Net profitability	The ratio of net profit to sales revenue.	0,12
X14	Return on equity	The ratio of net profit to the average annual cost of equity.	0,26
X15	Return on assets	The ratio of net profit to the average annual cost of assets.	0,09
X16	Ln (EVA)	The natural logarithm of the difference between net operating profit after taxation and the opportunity cost of invested capital.	11,35

* calculated by the author on the basis of the accounting (financial) statements of the companies included in the sample, as well as the data presented in Spark.

Next, let's check the impact of these factors on the company market capitalization. At the first stage, it is necessary to build a correlation matrix and exclude multicollinear factors. After multicollinear factor exclusion, two models were developed. In the first model, the explanatory models were the following ones:

the effect of financial leverage, economic value added and the profitability of net profit, and in the second model-the profitability of sales, the ratio of own working capital and the effect of financial leverage. The results of the regression analysis for the first model are presented in Table 2.

Table 2: Estimates of the regression coefficients for model 1[a].

Indicator	Coefficient	St. error	t-statistics	P-value	Value
const	13,29884831	0,501669715	26,50917109	7,39541E-45	***
X5	-3,00015402	0,59606667	-5,03325244	2,38289E-06	***
X13	8,943171363	1,531062526	5,841153587	7,75168E-08	***
X16	0,146872709	0,040525753	3,624182107	0,000474845	***
R^2			0,581526438		
Adj. R^2			0,567880561		
P-value			2,34234E-17		
F (3;92)			42,61554155		
Number of observations			96		
White's test for heteroscedasticity					
Zero hypothesis: no heteroscedasticity					
Test Statistics: LM=6, 93125					
p-value = P (Xu-square (9)> 6,93125) =0,644277					

Let's write the regression equation (the standard errors of the coefficients and the observed t-statistics are specified in parentheses):

$$Y= 13,3-3*x_5+8,9*x_{13}+0,15*x_{16} \quad (2)$$

(0,5) (0,596) (1,53) (0,04)

(26,51) (-5,03) (5,84) (3,62)

According to the performed analysis, this regression equation is statistically reliable, since the tabular value of the F-test with the degrees of freedom $k_1 = 3$ and $k_2 = nm-1 = 96 - 2 - 1 = 93$, equal to 2.7, is less than that obtained in this study of F-statistics. Next, you need to select the coefficients that were significant in the model by Student's criterion, the critical value of which is equal to 1.66. In Table 3 they are marked with two or three stars: the effect of financial leverage, economic value added and net profitability. All these coefficients are included in the model reasonably, since, as they noted earlier, the tabular value of the Student's criterion is 1.66, which is less than the t-statistics of all these coefficients. The value of the determination coefficient in the model was 58%, hence the change in economic value added by 58% depends on the influence of the data variables included in the model.

According to the obtained regression coefficients with 1% of financial leverage effect increase, the market capitalization decreases by 3%; with net profitability increase by 1% - by 8.9%; with economic value added increase by 1% - by 0.15%.

At the next stage, the check was performed according to the White test for heteroscedasticity. According to the results of the analysis, the null hypothesis of the absence of heteroscedasticity was confirmed.

As can be seen from Fig. 3, presented below, the average annual forecast Y is slightly better (since 2015) than the Y obtained by calculation. The scatter interval is small, primarily due to the observations made by key companies in the industry with comparable dynamics of activity. On the whole, the forecast was quite reliable.

The second model was developed in our regression analysis. The natural logarithm of market capitalization was also used as the dependent variable. The number of explanatory variables included the effect of financial leverage, the ratio of own working capital and return on sales.

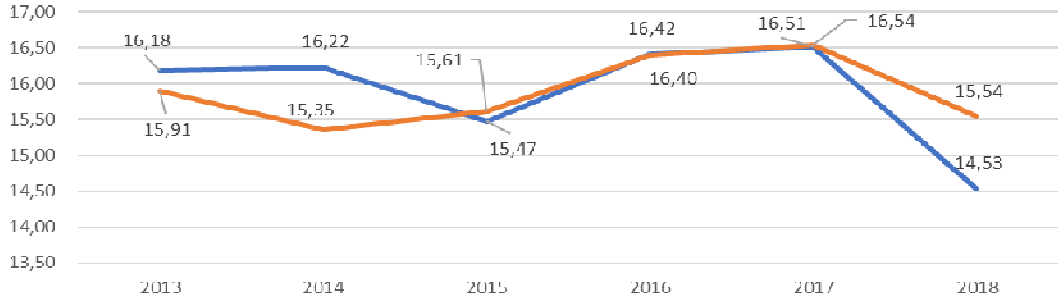

Fig. 3. Comparison of calculated Y with the predicted one by model 1.

Table 3: Estimates of the regression coefficients for the model 2[b].

Variable	Coefficient	St. error	t-statistics	P-value	Value
const	13,6628584	0,46179935	29,5861362	8,66E-49	***
X5	-3,8545289	0,58743545	-6,56162124	3,08E-09	***
X7	0,36084023	0,14019087	2,573921	1,17E-02	**
X12	13,3444897	1,87080126	7,13303441	2,19E-10	***
R^2	0,568297806				
Adj. R^2	0,554220561				
P-value	9,69575E-17				
F (3;92)	40,36995792				
Number of observations	96				
White's test for heteroscedasticity					
Zero hypothesis: no heteroscedasticity					
Test Statistics: LM=16,3137					
p-value= P (Xu-square (9)> 16,3137) =0,0606128					

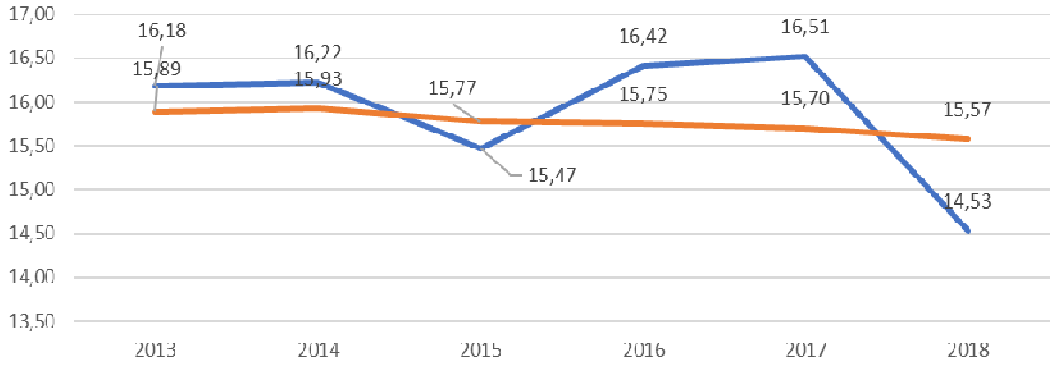

Fig. 4. Comparison of calculated Y with the predicted one by model 2.

Thus, in the first model, the emphasis was placed on the value approach in enterprise financial condition management, then the second model focuses on an effective capital structure development and a sufficient level of sales profitability maintaining. Table 3 presents the results of the regression analysis for the second model. According to the Fisher criterion, the model is significant, adequate to sample data (the critical value is 2.7). The p-value is 9.69575 E-17, which is significantly lower than the value of 0.05, that is, the model is significant at a five percent level. All coefficients included in the model are significant by Student's criterion. Let's note that the determination coefficient of our model was 56.8%, that is, in our model, the indicators by 56.8% explain the dependent variable. Relatively low value of the determination coefficient in both models is explained by the fact that a large number of factors affect the enterprises of the petrochemical industry. Besides, in order to obtain more balanced data, it is possible to increase the sample, as well as to include the enterprises of a single OKVED in it. Testing the model for homogeneity using the White's test for heteroscedasticity, confirmed that the empirical base is homogeneous. As can be seen from Fig. 4, the spread interval is noticeable, which indicates the lack of reliability of this model. Thus, from the point of view of the authors, the application of the first model is preferable from a practical point of view, the variation of the calculated and forecast values of the explanatory variable was small.

After the empirical study according to the petrochemical industry data, three of the six hypotheses were confirmed.

In the course of testing the first hypothesis, the existence of a significant positive relationship between the company market capitalization and profitability indicators (sales profitability and net profitability) was confirmed. Thus, with the growth of the company profitability, the market value increases. The relationship between the effective indicator and Economic Value Added (EVA) has been confirmed. It is one of the key metrics of enterprise performance, which acts as the tool that measures the actual profitability of a company and also controls it from the perspective of owners. Financial stability indicators have a significant impact on market capitalization: the ratio of own working capital and the effect of financial leverage. Let's note that the influence of the second is negative.

IV. CONCLUSIONS

Thus, in the course of this study, two models were built, which included petrochemical companies. These models indicate the parameters that need attention first of all to increase market capitalization. The constructed regression models have the correct specification and do not possess multicollinearity of factors and heteroscedasticity.

This topic has the potential for further research of oil and gas and petrochemical companies in Russia, and it is possible to advise to increase the sample to obtain more accurate results, as well as to include the companies with one OKVED in the sample.

ACKNOWLEDGEMENTS

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FOOTNOTE

[a] Compiled by the author using the Gretl software product based on the analysis of the financial statements of companies selected for the empirical research.
[b] Compiled by the author using the Gretl software product based on the analysis of the financial statements of companies selected for the empirical research.