



Smart Technologies as a Factor Affecting the Economic Efficiency of Oil and Gas Companies: The Case of Russia

L. V. Eder^{1,2(✉)}, I. V. Filimonova^{1,2}, and E. A. Makarova²

¹ Trofimuk Institute of Petroleum Geology and Geophysics of Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia

Ederlv@yandex.ru

² Novosibirsk State University, Novosibirsk, Russia

Abstract. The article focuses the impact of factors on the return on equity, as an indicator of the economic efficiency of oil and gas companies in Russia. Practical implementation of the decomposition method is presented; an econometric model based on panel data is built. As a result, recommendations to the Russian oil and gas company for improvement of economic efficiency were provided. Based on the econometric models built on panel data, it was shown that at present the economic efficiency of the industry is determined primarily by the indicator of the operating margin, as the ratio of revenue to profit. The significant influence has the level of operating costs, which depend, first of all, on the technological level of the company's development. In the context of a rapid decline in the operating costs of global transnational companies, the oil and gas industry faces significant challenges. In addition, the ratios of the tax burden and asset turnover was a significant factor as well.

Keywords: Smart technologies · Oil and gas companies · Economic efficiency · Oil price · Decomposition

1 Introduction

One of the main indicators of the efficiency of the enterprise is the return on equity (ROE), reflecting how effectively the company's own capital is used. Share capital has a major role among the sources for financing the company's activities. ROE is also an indicator for assessment of the company's investment attractiveness in the long term. ROE serves as an important financial indicator of returns for investors, as it allows to determine the growth of their welfare over the period under review.

A detailed study of the factors influencing the values of key indicators of the economic activity of enterprises is necessary in order to identify the reserves of efficiency and to make the managerial decisions. In this regard, factor modeling plays an important role in the analysis of the ROE. Analysis of the practical use of the model based on decomposition of ROE is described in the works of Liesz [1], Li [2], Burja [3] and others. Researchers such as McGowan [4], Almazari [5], Ongore [6] used methods of decomposition of ROE for the financial analysis of the banks. The result of the study of Delen [7] identified of a high dependence of ROE on operating profit, profitability of

sales and financial leverage. One of the key factors in the decomposition of ROE is the operating margin ratio. This indicator is defined by the level of development of smart technologies.

The purpose of the study is to determine the factors affecting the economic efficiency of Russian oil and gas companies, taking into account the technological development.

To achieve this goal, the following tasks were formulated:

- (1) Review of theoretical approaches to the assessment of the economic efficiency of oil and gas companies.
- (2) Implementation of methodological approaches to the decomposition of the ROE and the determination of factors affecting the economic efficiency of oil and gas companies.
- (3) Assessment of the impact of the identified factors on the ROE and practical recommendations to energy and oil and gas companies to improve economic efficiency.

The novelty of the study consist of the following. It was found that the ROE, as an indicator of the economic efficiency of companies, is most influenced by net profit margin and asset turnover. The turnover of assets and the net profit margin are related to the quality of the resource base, as well as the share of the products with high added value. At the same time, it was shown that, under the current conditions for most companies the turnover of assets has a negative correlation with the net profit margin.

2 Methodology

2.1 Method of Decomposition

The activities of companies are affected by various factors that have a direct impact on economic efficiency. In this regard, at the first stage of the study it was decided to use the ROE decomposition method, which allows: (1) to reflect the interrelation of financial and economic indicators involved in the assessment of the financial state of the company; (2) identify the factors that affect them; (3) contribute to the development of measures to improve these indicators.

Model of Dupont is one of the approaches that allow analyzing the profitability of a company's own capital, in the calculation of which the indicators of the company's production and financial performance are involved. The five-factor model of decomposition of ROE can be represented by the formula (1):

$$ROE = \frac{NP}{E} = \frac{NP}{EBT} \times \frac{EBT}{EBIT} \times \frac{EBIT}{S} \times \frac{S}{TA} \times \frac{TA}{E} \quad (1)$$

where NP – net profit, EBT – earning before tax, EBIT – earnings before interest and tax, S – sales, TA – total assets, E – equity.

Each ratio in formula (1) is a coefficient, which makes it possible to convert the five-factor model into the following form:

$$ROE = TBR \times IBR \times NPM \times ATO \times FLEV \quad (2)$$

where TBR is tax burden ratio, IBR – interest burden ratio, NPM – net profit margin, ATO – assets turnover, FLEV – financial leverage.

Financial leverage is an addition to the ROE, obtained through the use of borrowed capital. The asset turnover characterizes the volume of sales that can be obtained by the given assets. The ratio of interest burden illustrates how much of the profit from main activities remains after interest. The tax burden ratio reflects what part of the profit remains at the disposal of the enterprise after payment of taxes. The growth of this indicator can be observed if the company uses tax minimization schemes. The operating margin characterizes what percentage of the revenues remains with the company after deduction of taxes and interest.

2.2 Method of Panel Regression

At the second stage of the study the assessment of the influence of each of the identified factors was carried out via econometric models based on panel data. Panel data are observations of the same objects, which are carried out in consecutive periods. Models of pulled regression, fixed-effect model, and a random effect were considered.

3 Data

In this research, factors that influence the ROE of the largest players in the country's oil and gas complex are studied. For this purpose, quarterly data were collected on six major oil and gas companies in Russia in 2015–2017

4 Empirical Results

At the first stage, the decomposition of ROE was carried out to identify the factors that have a significant impact on the efficiency of oil and gas companies. Further, in order to mitigate the impact of one-time decisions by the management of companies, as well as changes in the conditions of the external market conjuncture during the year, the additive increments of the collected quarterly data were taken within 3 years. Thus, this the calculations have been cleared of random changes that could affect the financial results of a particular year.

For the regression analysis on the basis of panel data, a number of hypotheses were formulated regarding the factors affecting the efficiency of the use of equity.

- 1: the tax burden ratio is significant and positively affects the ROE.
- 2: the interest burden ratio is significant and positively affects the coefficient of ROE.
- 3: the net profit margin is significant and positively affects the ROE.

- 4: the asset turnover ratio is significant and positively affects the ROE.
- 5: the coefficient of financial dependence is significant and positively affects the ROE.

To test the hypotheses of the study, an econometric model was built to describe the relationship between the ROE and the factors considered.

$$ROE_{it} = const + a_1TBR_{it} + a_2IBR_{it} + a_3NPM_{it} + a_4ATO_{it} + a_5FLEV_{it} + \mathcal{E}_{it} \quad (3)$$

where ROE_{it} is ROE of object i at period t , TBR_{it} – tax burden ratio of object i at period t , IBR_{it} – interest burden ratio of object i at period t , NPM_{it} – net profit margin of object i at period t , ATO_{it} – assets turnover of object i at period t , $FLEV_{it}$ – financial leverage of object i at period t , $const$ – constant, \mathcal{E}_{it} – random error of object i at period t , a_i – coefficient of regression.

The obtained results justified the choice of the model with fixed effects (Table 1), since the p-level of the regression is less than 0.05 (Prob > chi2 = 0.0436).

$$ROE_{it} = 0,15 * TBR_{it} + 0,09 * IBR_{it} + 0,28 * NPM_{it} + 0,21 * ATO_{it} + 0,001 * FLEV_{it} - 0,32 \quad (4)$$

Table 1. Results of a model with fixed effects.

F (5,61) = 27.44						
Prob > F = 0.0000						
R-squared:	within = 0.6923 between = 0.6534 overall = 0.6728					
Corr (α_i , Xb) = -0.0465						
Variable	Coefficient	Standard error	t-statistics	p - level	95% interval	
TBR	0,146	0,061	2,39	0,030	0,025	0,476
IBR	0,088	0,056	1,57	0,016	0,036	0,293
NPM	0,281	0,048	5,83	0,000	0,184	0,377
ATO	0,206	0,021	9,51	0,000	0,163	0,249
FLEV	0,001	0,030	0,03	0,001	0,064	0,208
Constant	-0,322	0,173	-1,86	0,068	0,668	0,021
F test that all $\alpha_i = 0$:		F(5, 61) = 3.38		Prob > F = 0.0043		

5 Discussion and Conclusion

Based on the results of the built econometric model for the largest oil and gas companies in Russia, all of the hypotheses were confirmed. According to the evaluation of the factors, the ROE is mainly determined by the variation of the net profit margin and asset turnover, then by the tax burden ratio, and to a lesser extent by the interest burden ratio and the company’s financial dependence (Table 2).

Table 2. Decomposition of ROE of Russian oil and gas companies on average in 2015–2017.

Company	ROE	Tax burden	Interest burden	Net profit margin	Assets turnover	Financial leverage
LUKOIL	9%	0,77	0,93	7%	1,11	1,53
Rosneft	8%	0,72	0,73	10%	0,49	3,05
Gazprom Neft	13%	0,81	0,92	16%	0,61	1,84
Tatneft	16%	0,76	0,96	26%	0,61	1,43
NOVATEK	26%	0,83	0,97	38%	0,55	1,62
Bashneft	27%	0,79	0,89	19%	1,04	2,08
Average	17%	0,78	0,90	19%	0,73	1,93

Net profit margin has the greatest impact on the performance of oil and gas companies. The costs of the companies of the oil and gas industry increase due to the deterioration of the mineral resource base of traditional oil reserves, as well as the increase in the share of the gas condensate production, the involvement of small and flooded fields in the development, the use of oil production intensification technologies, the rise in the cost of service, and the increased complexity of development [8–12].

The relationship between asset turnover and operating margin for Russian oil and gas companies was revealed. Growth of asset turnover and high added value is created due to a significant increase in investments and production costs, as a result of which the operating margin is declining.

The operating margin indicates the profitability of the company, depending on its ability to control costs. In recent years, there has been a reduction in the production of traditional oil and an increase in the share of hard-to-recover hydrocarbons, which leads to an increase in the operating costs per unit of the companies. Companies could compensate for significant expenses only in conditions of high oil prices [13–17].

The leader in net profit margin among the considered companies is NOVATEK. The technologies of this company allow the implementation of projects in the Arctic zone for LNG production. At present, Tatneft is one of the most high-tech oil companies in Russia, which allows for achievement of a relatively high operating margin. Long before the introduction of sanctions, this company began to make significant efforts to develop its own technologies for development and extraction of hard-to-recover oil reserves in the Republic of Tatarstan. To a large extent, this applies to another regional company, Bashneft, while it was independent. The companies mentioned above have the most effective technologies in the field of oil and gas production, which allows them to achieve a relatively high operating margin. LUKOIL has one of the lowest operating margins of sales, as it has a very large complex of oil processing and petrochemicals in Russia. The investments of this company in highly capital-intensive projects have a significant impact on operating margins, and hence the ROE. Bashneft has the optimal ratio between the asset turnover and operating margins of sales.

The turnover of assets is determined by the availability of idle assets, their inefficient use, as well as the sale of products with low added value. For oil and gas companies this has several key implications. First, in oil production, the efficiency of

assets is determined by the quality of the resource base. A high share of hard-to-recover hydrocarbons in the structure of reserves and production reduces the turnover of assets and ration of revenue per unit of investment [18–21].

Significant factors that affect the economic efficiency of development is the fiscal policy in the field of taxation, as well as financial leverage.

Acknowledgments. The research was supported by RFBR grant № 17-0600537 and grant of the President of the Russian Federation MD-6476.2018.6.

References

1. Liesz, T.J.: Really modified Du Pont analysis: five ways to improve ROE. *Econ. Rev.* **81**(3), 231–243 (2004)
2. Li, M., Nissim, D., Penman, S.H.: Profitability decomposition and operating risk (2014). <https://carlsonschool.umn.edu/file/13416/download?token=A4tP-JRS>. Accessed 12 March 2018
3. Burja, V., Mărginean, R.: The study of factors that may influence the performance by the Dupont analysis in the furniture industry. *Procedia Econ. Finance* **16**, 213–223 (2014)
4. McGowan Jr., C.B., Stambaugh, A.R.: Using disaggregated return on assets to conduct a financial analysis of a commercial bank using an extension of the DuPont system of financial analysis. *Acc. Finance Res.* **1**(1), 152–161 (2012)
5. Almazari, A.A.: Financial performance analysis of the Jordanian Bank by using the DuPont system of financial analysis. *Int. J. Econ. Finance* **4**(4), 86–94 (2012)
6. Ongore, V.O., Kusa, G.B.: Determinants of financial performance of commercial banks in Kenya. *Int. J. Econ. Finance Issues* **3**(1), 237–252 (2013)
7. Delen, D., Kuzey, C., Uyar, A.: Measuring firm performance using financial ratios: a decision tree approach. *Expert Syst. Appl.* **40**(10), 3970–3980 (2013)
8. Filimonova, I.V., Eder, L.V., Mishenin, M.V., Mamakhatov, T.M.: Current state and problems of integrated development of mineral resources base in Russia. In: IOP Conference Series: Earth and Environmental Science, vol. 84, no. 1, p. 012011 (2017)
9. Eder, L.V., Filimonova, I., Nemov, V., Provornaya, I.: Forecasting sustainable development of transport sectors of Russia and EU: energy consumption and efficiency. *Int. J. Energy Econ. Policy* **8**(2), 74–80 (2018)
10. Kontorovich, A.E., Eder, L.V., Filimonova, I.V., Nikitenko, S.M.: Key problems in the development of the power of Siberia project. *Reg. Res. Russ.* **8**(1), 92–100 (2018)
11. Kontorovich, A.E., Eder, L.V., Filimonova, I.V.: Paradigm oil and gas complex of Russia at the present stage. In: IOP Conference Series: Earth and Environmental Science, vol. 84, no. 1, p. 012010 (2017)
12. Eder, L.V., Filimonova, I.V., Provornaya, I.V., Nemov, V.Yu.: The current state of the petroleum industry and the problems of the development of the Russian economy. In: IOP Conference Series: Earth and Environmental Science, vol. 84, no. 1, p. 012012 (2017)
13. Eder, L.V., Filimonova, I.V., Nemov, V.Y., Provornaya, I.V.: Forecasting of energy and petroleum consumption by motor transport in the regions of the Russian federation. *Econ. Region* **13**(3), 859–870 (2017)
14. Eder, L.V., Filimonova, I.V., Provornaya, I.V., Nemov, V.U., Nikitenko, S.M.: Regional smart specialisations in fostering innovation development of resource regions of Russia. In: International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM 2017, vol. 53, pp. 727–734 (2017)

15. Eder, L.V., Kontorovich, A.E., Filimonova, I.V., Provornaya, I.V., Goosen, E.V.: Regional innovation cluster: environmental issues and efficient use of resources. In: International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM 2017, vol. 53, pp. 719–726 (2017)
16. Eder, L., Provornaya, I.: Analysis of energy intensity trend as a tool for long-term forecasting of energy consumption. *Energ. Effi.* **11**, 1–27 (2018)
17. Nikitenko, S.M., Mesyats, M.A.: Objects of industrial property as an instrument for introducing technological innovations in machine building. In: IOP Conference Series: Materials Science and Engineering, vol. 253, no. 1, p. 012024 (2017)
18. Sharf, I.V.: Financial and organizational aspects of the recovery of hydrocarbon resource base in the regional context. *Econ. Region* **13**(2), 628–640 (2017)
19. Nikitenko, S.M., Goosen, E.V.: Socio-economic development of territories based on the principles of public-private partnership in the sphere of comprehensive mineral exploration. In: IOP Conference Series: Earth and Environmental Science, vol. 84, no. 1, p. 012013 (2017)
20. Manusov, V.Z., Antonenkov, D.V., Solovev, D.B.: Estimation of energy consumption of Dm-H drill rig main drive in far north conditions. In: 2018 International Multi-conference on Industrial Engineering and Modern Technologies (FarEastCon), International Conference on, pp. 1–5 (2018). <http://dx.doi.org/10.1109/FarEastCon.2018.8602484>
21. Tagaeva, T.O., Baranov, A.O., Gilmundinov, V.M.: Assessment of the required changes of Russian ecological taxes. *Int. J. Energy Econ. Policy* **6**(3), 611–616 (2016)