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ANALYSIS OF INFLUENCE OF BASIC EXTERNAL AND INTERNAL FACTORS ON THE PROSPECTS OF DEVELOPMENT OF OIL INDUSTRY OF RUSSIA

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ABSTRACT

The authors of the study analyzed the relationship between the selling price of oil and the US dollar exchange rate, as well as their impact on the main indicators of the oil field development project. An approach is proposed for analyzing the sensitivity of project indicators to changes in the considered interrelated factors. The results of the implementation of the proposed approach are presented both in the current legislation and in conditions of the completion of the tax maneuver with an increase in the tax on mining. The results can be used in the practical activities of design organizations working in the field of oil production, as well as in the educational and teaching activities of specialized departments (taxation, general management, etc.). The study used such methods as the collection and statistical analysis of information on oil selling prices and exchange rates, comparisons and analogies, as well as econometric methods such as correlation and regression analysis, time series analysis, which allows to determine the relationship between economic indicators. The novelty of the research lies in the developed approach for analyzing the sensitivity of the main indicators of the oil field development project, based on the use of a possible correlation between the initial indicators: the price of oil sales and the US dollar exchange rate, which allows for more correct conclusions about the project's resilience to risks.

INTRODUCTION

In market conditions, the responsibility of the subsoil user and the state for the rational use of hydrocarbons is growing, requirements for oil organizations for the full implementation of design decisions in the field of oil field development are increasing. Oil companies must comply with rational development requirements and ensure at least a minimum profitability for their own development. Failure to comply with these requirements threatens companies with sanctions until the withdrawal of the license. In this regard, the subsoil user must monitor the development status in accordance with applicable rules and guidelines, carry out research to conduct continuous analysis and design of oil field development [1, 2].

The main task of the subsoil user and the state, represented by the owner of the subsoil, is to determine the recommended (best) option for the development of a raw hydrocarbon field (hereinafter - RHC). To determine the level of exposure of the recommended development option to possible risks, we analyze the sensitivity of such indicators as the net present value of the subsoil user, the discounted state revenue, as well as cost-effective reserves depending on the export price of hydrocarbons, capital, and current costs.

Changes in the oil export price can have a direct impact on such economic indicators as revenue from oil sales, the tax rate on mineral extraction, the rate of export duties, and indirectly affect the exchange rate of the US dollar. The significance of the presence of such interdependence in the analysis of the sensitivity of the main indicators of the project is supported by the combined influence of these factors on the net income from the implementation of the project [3-5].

MATERIALS AND METHODS

The presence of a relationship between the considered indicators can be determined using econometric methods. For their implementation, it is necessary to determine the type of statistical information to be analyzed and the frequency: average for a year, months, or for every day.

The more information is analyzed, the more reliable the results of the study will be. In accordance with the Rules for Monitoring the Price of Urals Crude Oil on the World Petroleum Market (Mediterranean and Rotterdam) [6], monitoring is carried out in order to determine the average selling price of oil by the Ministry of Economic Development of the Russian Federation by observing and recording daily oil prices (buying and selling) published by the international price agency - Argus Media Limited (Argus Crude publication, quotation names - URALS NWE and URALS MED 80kt, unit of measurement is US dollars per barrel). There is no free access to the resources of this agency. But the Ministry of Economic Development of the Russian Federation publishes information on average monthly oil sales prices [7]. This aspect is key in determining the frequency of statistical information to be further analyzed.

An increase in the analyzed range of the source data does not always positively affect the results of

KEY WORDS

oil field development project, oil export price, sensitivity analysis, correlation, regression model.

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econometric modeling. Relationships of indicators, especially economic ones, at a certain point in time can change or even disappear. In this regard, it is necessary to analyze the stability of the model or use small amounts of data, within which it is assumed that the dependence formed at the current time is.

The correlation-regression analysis is necessary to determine whether there is a relationship between the variables and build a regression model that describes their relationship. The choice of the regression model, as well as the frequency, has a significant impact on the results of the analysis. In the process of selecting the type of regression, one should adhere to the rule "the model should be as reliable as possible and, at the same time, the simplest." Therefore, in this case, the choice of paired linear regression is the most appropriate.

Regarding time series models, their use in the economic evaluation of field development projects is inappropriate. This is due to the fact that the calculations, according to temporary methodological recommendations, are carried out by year and there are no cyclic fluctuations in this case. If it is necessary to carry out a calculation in a more detailed time interval for a short period of time, the modeling of time series would definitely make a significant contribution to forecasting the information users who are interested.

Once the type of model, the frequency, as well as the period of statistical information is selected, these aspects should be considered when conducting sensitivity analysis in accordance with methodological recommendations for the preparation of technical projects for the development of hydrocarbon deposits.

RESULTS

For a sensitivity analysis, the export prices are the values of Urals oil selling prices. The change in the export price affects the export netback necessary for calculating the revenue from the sale of hydrocarbons, the mineral extraction tax rate (MET), and the export duty rate. In turn, simultaneously with the level of selling prices for Urals oil, the same economic indicators are affected by the value of the US dollar exchange rate [Fig. 1].

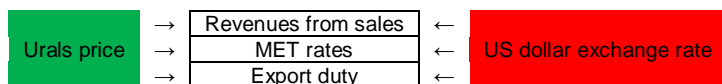


Fig. 1: The effect of Urals crude price and US dollar exchange rate on estimated economic indicators.

Thus, to conduct a sensitivity analysis, we need to answer the question: should the relationship between the export price of hydrocarbon sales and the US dollar exchange rate, if any, be taken into account? To do this, we shall consider the monthly average data for the period from January 2003 to September 2018 [Fig. 2] [8].

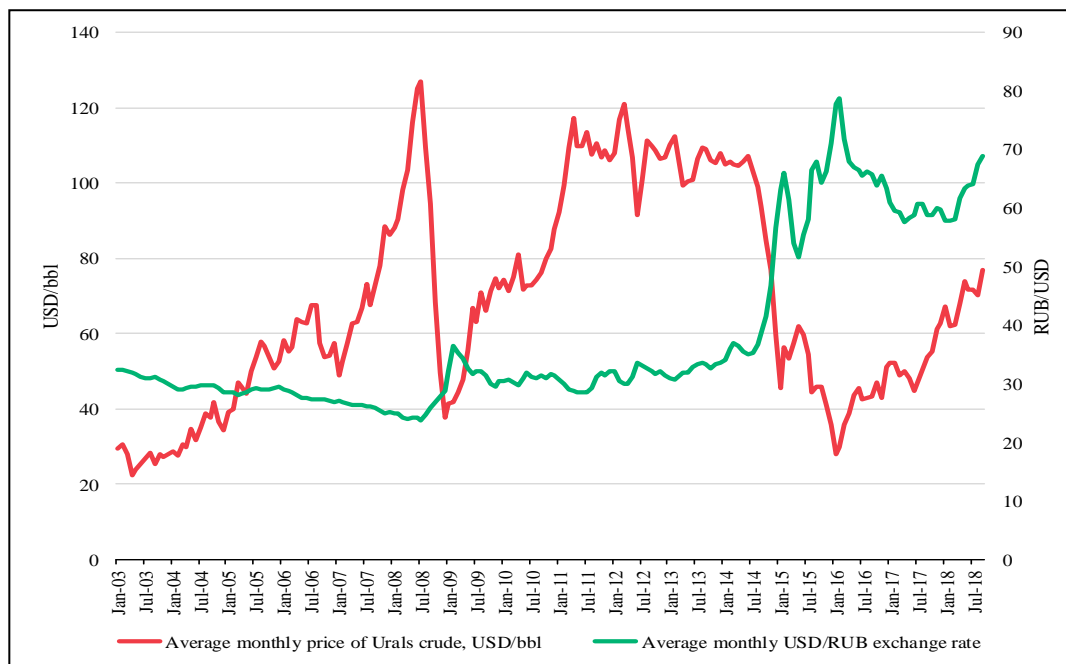


Fig. 2: Changes in the average monthly oil price and the US dollar over time.

[Fig. 2] shows that there is an inverse relationship between the considered indicators at certain time

intervals. Moreover, their elasticity is not constant. For a more detailed analysis, we construct the correlation field of the average monthly oil selling price and the US dollar exchange rate [Fig. 3].

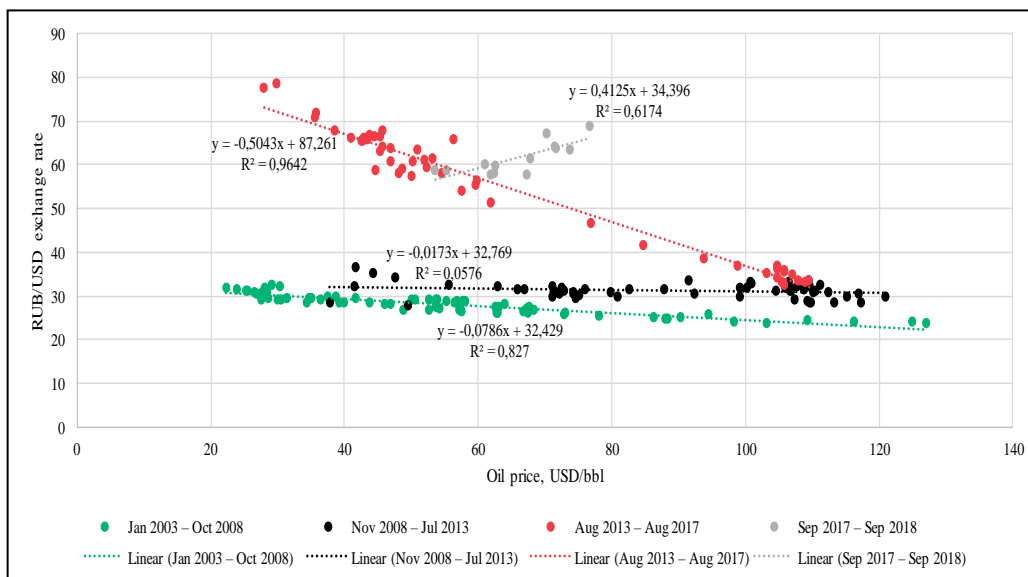


Fig. 3: The correlation field between the average monthly values of the US dollar and the price level of Urals oil.

[Fig. 3] demonstrates the inconstancy of the correlation of the considered indicators. From January 2003 to October 2008, there was a fairly strong inverse relationship between the selling price of oil and the exchange rate of the US dollar. From November 2008 to July 2013, there is no correlation between these indicators. From August 2013 to August 2017, a high correlation was observed. And from September 2017 till present, the relationship has become direct.

These findings can also be associated with an analysis of the dynamics of such indicators as the export duty rate, the MET rate and the export netback [Fig. 4]. To compare data, the calculation of the considered indicators was performed under the legislation for subsoil users in force at the end of 2018.

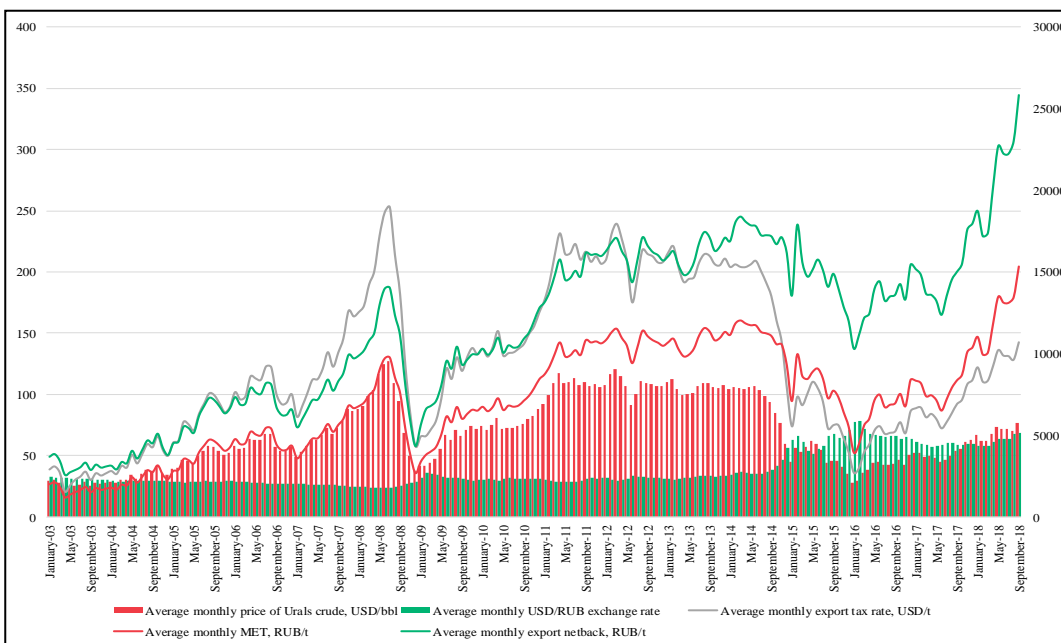


Fig. 4: Comparison of the dynamics of economic indicators.

[Fig. 4] shows that, from 2003 to 2009, the change in the selling price of Urals oil was comparable to the MET rate. From 2009 to mid-2013, such comparability was observed between the export duty rate and the export netback. From 2015 to September 2017, export duty and MET rates are comparable. Around the same periods, various relationships were observed between the selling price of oil and the exchange rate of the US dollar.

We shall carry out a correlation analysis between these indicators for each of the selected time periods. In the first time period - from January 2003 to October 2008, there are strong dependencies between all variables [Table 1]. The export duty rate calculated according to the current legislation will in all cases have a close, and sometimes complete functional dependence on the selling price of Urals oil [9]. This time period is characterized by an inverse strong correlation between the selling price of oil and the US dollar exchange rate, which is clearly shown in [Fig. 3]. A netback has a strong direct correlation with the selling price of oil and an inverse strong correlation with the US dollar exchange rate.

Table 1: Correlation matrix between variables for the period from January 2003 to October 2008

	Urals	Exchange rate	Duty	Netback	MET
Urals	1				
Exchange rate	-0.90938	1			
Duty	0.999978	-0.90988	1		
Netback	0.995154	-0.88633	0.995206	1	
MET	0.99638	-0.89954	0.996485	0.999561	1

From November 2008 and July 2013, the correlation between the selling price of oil and the US dollar exchange rate almost ceases to exist [Table 2] [10]. Netback and MET rates also have no correlation with the exchange rate. There is a strong direct correlation between variables with the exception of the US dollar.

Table 2: The correlation matrix between variables for the period from November 2008 to July 2013

	Urals	Exchange rate	Duty	Netback	MET
Urals	1				
Exchange rate	-0.26971	1			
Duty	1	-0.26971	1		
Netback	0.982238	-0.09796	0.982238	1	
MET	0.988341	-0.13707	0.988341	0.999224	1

From August 2013 to August 2017, the correlation between the selling price of oil and the exchange rate of the US dollar again became strong and inverse [Table 3]. All indicators also have a close relationship with each other.

Table 3: The correlation matrix between variables for the period from August 2013 to August 2017

	Urals	Exchange rate	Duty	Netback	MET
Urals	1				
Exchange rate	-0.98194	1			
Duty	1	-0.98194	1		
Netback	0.879717	-0.85043	0.879717	1	
MET	0.951211	-0.93897	0.951211	0.979498	1

Since September 2017, the situation has changed dramatically. The high correlation between the selling price of oil and the exchange rate of the US dollar has changed the direction from an inverse relationship to a direct one [Table 4]. Netback is directly dependent on the selling price of oil and the exchange rate of the US dollar.

Table 4: The correlation matrix between variables for the period since August 2017

	Urals	Exchange rate	Duty	Netback	MET
Urals	1				
Exchange rate	0.785742	1			
Duty	1	0.785742	1		
Netback	0.96581	0.91863	0.96581	1	
MET	0.975559	0.901595	0.975559	0.999153	1

Thus, the assessment of the economic efficiency of oil field development projects should take into account the regression relationship. For comparability of the calculations to the requirements of temporary guidelines for the preparation of technical projects for the development of hydrocarbon deposits, it is necessary to conduct an analysis for a period equal to the last 12 months, consisting of average selling prices of Urals oil and the exchange rate of the US dollar. For the analyzed indicators, a linear pair

regression is constructed, the obtained values of which can be used to predict changes in the currency exchange rate from changes in oil sales prices. With this calculation, the constructed regression equation will always go through the average annual values of the analyzed indicators.

SUMMARY

The proposed approach allowed us to achieve the quality of a simulated adaptive floating model for the period from January 2003 to September 2018 at the level of 99.01%. The graph of the dynamics of the initial data of the US dollar exchange rate and model values is presented in [Fig. 5].

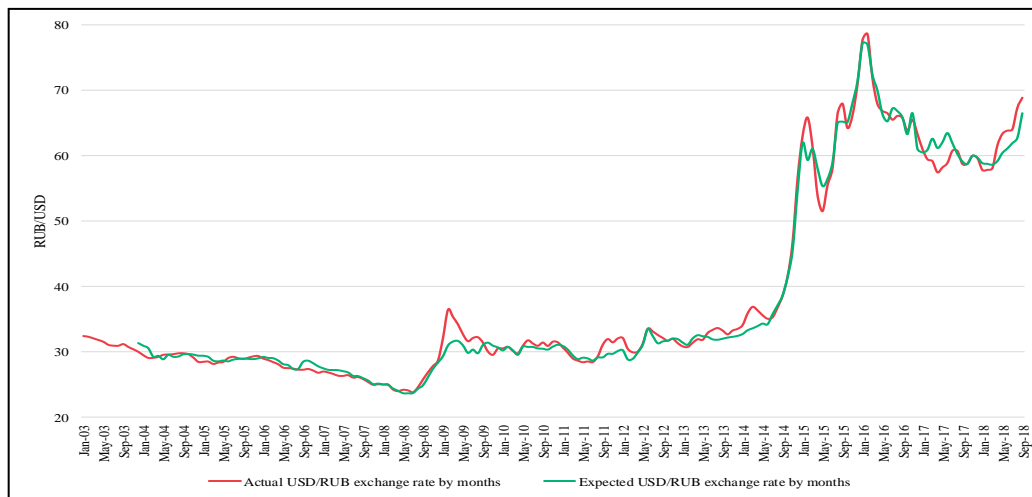


Fig. 5: Changes of actual and forecast average monthly values of the US dollar over time.

The sensitivity analysis of the export netback of crude oil in this case is presented in the form of a spider chart in Figure 6. Since September 2017, the relationship between the selling price of oil and the dollar exchange rate has changed from the direct to the direct, the graph shows the range of changes in the export netback from taking into account the dependence increased (with an inverse dependence should decrease).

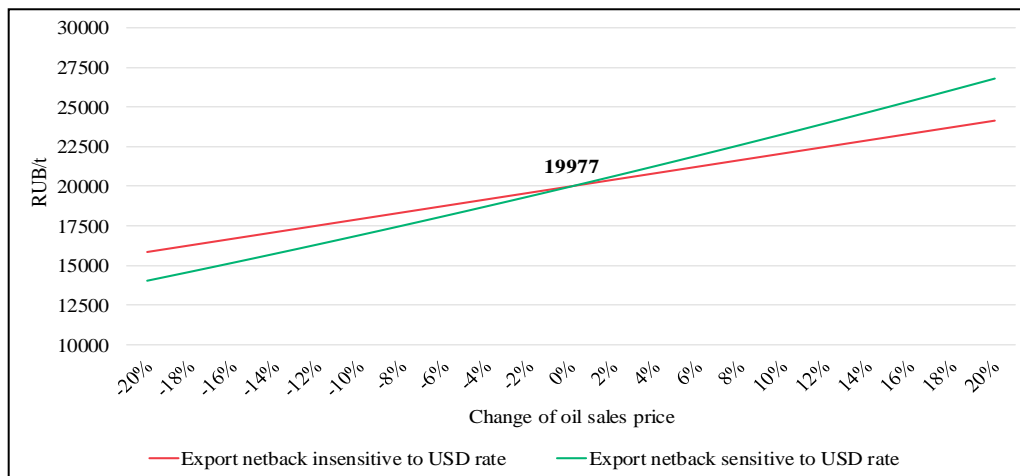


Fig. 6: Analysis of the sensitivity of the export netback for crude oil, both with and without the adaptive regression relationship between the selling price of oil and the exchange rate of the US dollar according to September 2018.

The dynamics of the export netback for crude oil with a change in the selling price, taking into account the relationship on the exchange rate of the US dollar for the proposed approach, is presented in [Fig. 7].

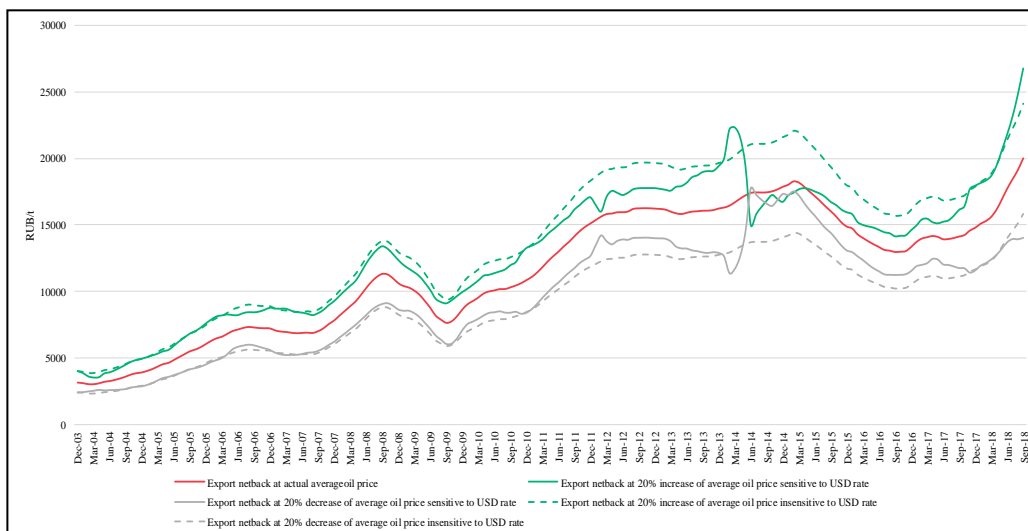


Fig. 7: Changes in crude oil export netback over time.

As part of this study, an analysis was made of the impact of legislative changes regarding the tax severance tax on the MET on the results of a sensitivity analysis of the proposed approach [Fig. 8].

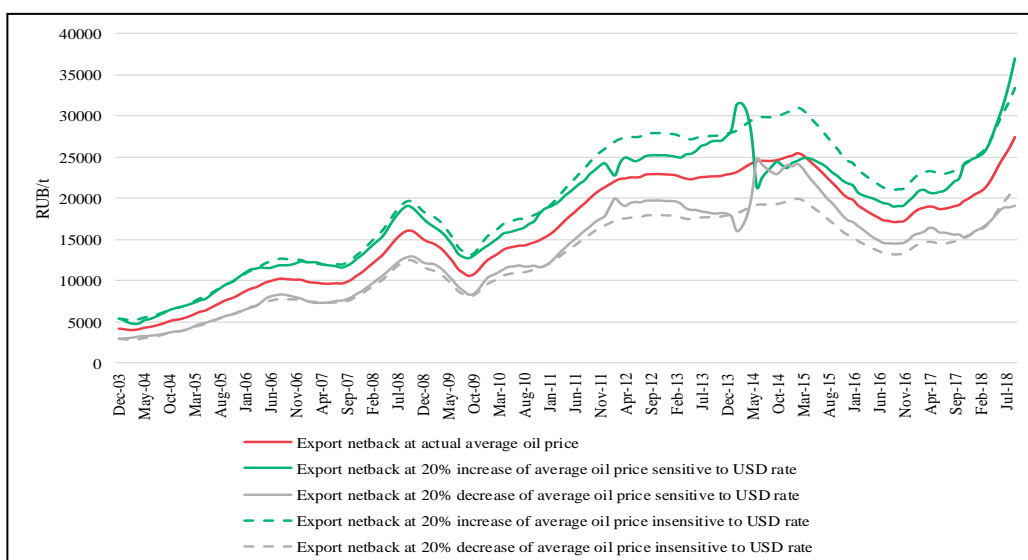


Fig. 8: Changes in the export netback of crude oil over time subject to the completion of the tax maneuver for mineral extraction tax.

In general terms, a tax maneuver involves a gradual (within 5 years) conversion of the customs duty rate to the MET rate [11, 12]. Upon completion of such a maneuver, the export netback should increase, as the export duty rate will be 0. At the same time, deductions to the budget due to mineral extraction tax will increase. Moreover, an increase in netback (reduction in the rate of export duty) and the MET rate will be carried out by the same amount. Net income of a subsoil user, both discounted and non-discounted, will not change. Only relative economic indicators will change (cost-effectiveness index and investment profitability index). Also, the dynamics of the export netback practically did not change, and the values of the indicators increased due to the zeroing of the customs duty rate; the interpretation of the results remains unchanged.

CONCLUSION

Project payback, net present value of the subsoil user, internal rate of return, return on investment, and cost indices are subject to risk. Satisfying the requirements of the subsoil user, the values of these indicators should be resistant to changes in various factors: the selling price of oil, the level of oil production, the amount of capital investment, the level of current costs. However, it is necessary to take into account the possibility of the influence of factors on each other.

Using the approach proposed in this work to determine the regression relationship between the selling price of oil and the US dollar exchange rate, it is possible to more reliably predict changes in economic indicators

that affect the efficiency of oil field development projects. The proposed approach allows for a more reliable analysis of the sensitivity of technical and economic indicators.

CONFLICT OF INTEREST

There is no conflict of interest.

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