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GLOBAL ENERGY MARKET: DEVELOPMENT TRENDS AND RELATIONSHIPS BETWEEN ITS INDIVIDUAL SECTORS

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Abstract:

The energy market is one of the key factors in the functioning of various business entities and economic development in general. Here it is important to take into account the conditions for the formation of such a market, the influence of various factors on its dynamics and trends in its development. For these purposes, it is advisable to consider data from the corresponding segment of the stock market on which securities of various energy market companies are traded. The dynamics of quotes for such securities helps to understand the obvious and hidden trends in the functioning of such a market. Based on this, the work examines quotes for the classical components of individual segments of the energy market. Among these components, prices for oil, gas, gasoline and fuel oil are highlighted. The work presents graphs for different data and their individual statistical characteristics. The dynamics of the relationship between individual segments of the energy market are also considered. The research results are confirmed by individual graphs and estimates, which also makes it possible to understand the overall progress of the study.

Key words: Development, Interrelation, Oil, Gas, Gasoline, Fuel Oil, Energy Market, Statistical Analysis, Stock Indices

INTRODUCTION

Economic development is largely possible on the basis of free access to various types of resources. In modern conditions, among such resources, a special place is given to energy resources [1], [2]. Such resources make it possible to operate various machines and mechanisms, which ensure the functioning of many types of production of goods and services. Energy resources are also capable of being transformed into individual benefits that are necessary for the life of mankind. This determines the relevance and importance of this research topic.

The role and significance of energy resources is determined through the classical scheme of their supply and demand. This is reflected in the price of such resources, where the stock market plays a significant role [3]-[5]. By trading securities for various types of energy resources, their significance and relevance for economic development are determined. Here we can highlight such components of the classical energy market as securities for quotations for oil, gas, gasoline, and fuel oil. On the one hand, such dynamics reveal individual trends in the development of the classical component of the energy market, on the other hand, it allows us to analyze its individual segments. This facilitates a comprehensive data analysis based on the topic of this study.

To carry out the appropriate analysis, it is first of all important to know the dynamics of quotes for various securities of the energy market. Here, both traditional methods of analyzing such data [6]-[14] and non-standard approaches can be used, which allow us to analyze the presented data in a new way and obtain additional information [15]-[25]. It is also advisable to

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study the mutual dynamics of data for individual segments of the energy market. This will make it possible to assess their mutual influence on each other, to assess the influence of various factors on the formation of the corresponding securities quotes. Ultimately, this will be effective for the purpose of developing a strategy for entering the relevant segment of the stock market.

Thus, the main goal of this work is to study the general trends in the development of the classical energy market and its individual sectors. In this aspect, special attention is paid to such market components as: oil, gas, gasoline and fuel oil. Also, one of the tasks of this article is to analyze related studies.

Related work

Analysis of the energy market can cover various areas of research, where an important place is given to the dynamics of quotes for relevant securities and methods of such analysis.

L. G. Chuvakhina, I. Z. Yarygina, O. E. Ustinova, V. N. Mironova and Z. V. Ivanovskaya consider various factors influencing prices on the world oil market [26]. Particular attention is paid to the impact of COVID-19 on price levels. The article also analyzes monetary policy measures designed to stimulate business activity. The study uses correlation analysis, which allows us to estimate the level of inflation and the volume of oil production. This allows us to draw the necessary conclusions when choosing a development strategy.

M. Coskun analyzes the relationship between clean energy subsector stocks and commodity futures markets [27]. Attention is paid to dynamic correlations to side effects. Oil has been shown to transmit the highest volatility spillovers to biofuels and the least to the fuel cell industry [27]. At the same time, natural gas and coal cause the greatest volatility side effects in the energy storage industry [27]. The paper also presents time-varying average optimal hedging ratios. This is important when developing investment strategies.

L. K. Orlik and I. F. Khasanova study the dynamics of exchange rates and oil prices, which are used in adaptive analysis and forecasting [28]. The article examines the dependence of currency pair quotes on the price of Brent oil. The analysis is carried out using the correlation method. As a result, multivariate generalizations of the correlation coefficients of modified and adaptive time series were obtained [28]. This allows for more detailed data analysis than classical theory suggests. This can be used for forecasting using ARIMA, TBATS and neural networks models.

B. Kruyt, D. P. Van Vuuren, H. J. de Vries and H. Groenenberg conduct a comprehensive analysis of energy security indicators, which also takes into account the dynamics of quotations on the energy market [29]. The authors highlight the following dimensions of energy security: resource availability, affordability, energy acceptability. Various analysis scenarios using individual models are considered. As a result, the discrepancy between consumption and production based on international energy trade is shown. The possible benefits of climate policy in this matter are also noted.

R. D. Huang, R. W. Masulis and H. R. Stoll consider the relationship between energy shocks and financial markets [30]. The authors analyze the information transmission mechanism linking oil futures to stock prices. For these purposes, the degree of simultaneous correlation of these markets is examined, paying special attention to the relationship of oil price indices with the S&P 500 index [30]. The degree of change in prices and profitability is also considered. The authors use VAR model estimates for different time series of returns.

D. Kumar, P. K. Sarangi and R. Verma in their study review methods for analyzing the stock market using machine learning and statistical methods [31]. First, the authors note that stock

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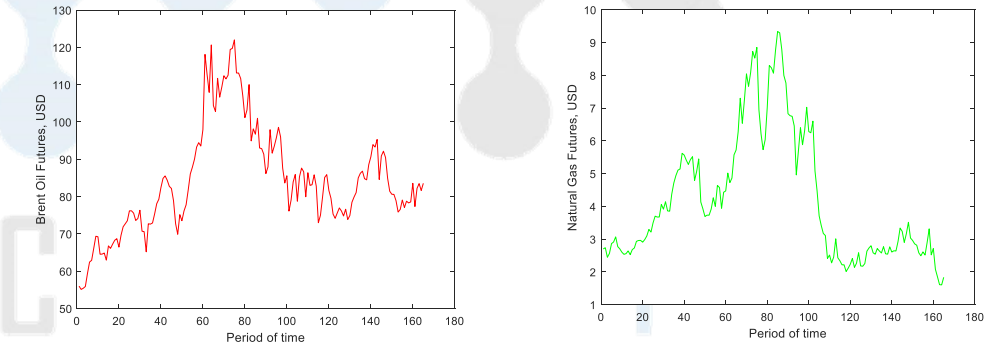
market forecasting models are considered an important activity in developing investment strategies. This is because stock prices will result in lucrative returns from making smart decisions. At the same time, stock market forecasts use mathematical strategies and learning tools, among which are: calculation methods, machine learning algorithms, and performance parameters. It is concluded that stock market forecasting is a complex process.

F. Alamgir and S. B. Amin consider the relationship between the price of oil and the stock market [32]. The study used data from South Asia. The analysis uses a nonlinear autoregressive distributed lag (NARDL) model. Data for the period 1997-2018 were considered. A positive relationship was found between the world oil price and the stock market index. At the same time, the reaction of the stock market index to positive and negative oil price shocks is asymmetric [32]. This allows for informed selection of appropriate investment strategies. It is also shown that higher oil prices in the global market stimulate stock prices. This suggests that South Asian countries do not follow the efficient market hypothesis (EMH) [32].

We see that the study of trends in the functioning and development of the energy market takes due attention in the works of various researchers. In this case, various data sets are used, which makes it possible to properly display individual aspects of such a market and its components. Various methods and approaches for data analysis are also considered. At the same time, it is important to pay attention to the mutual dynamics of the relevant data, which will be done later in this work.

Dynamics of quotes for individual energy market futures

This study examines quotes for futures for oil, gas, gasoline and fuel oil. All data covers the period 01.03.21-02.25.24 and is taken from the website www.investing.com. Below are the data of such quotes.



a) Oil b) Gas

Figure 1: Dynamics of quotations for oil and gas futures

In Fig. 1 shows the dynamics of quotes for oil and gas futures. First of all, it should be noted the diverse dynamics from the point of view of the period under review for such quotes.

Thus, in the first third of the studied period of time, an increase in the studied quotes is observed. Here we also note the achievement of maximum values: for oil – 122.01, for gas – 9.336.

Then there is a decline in such quotations. At the end of a third of the period under study, a new increase in oil and gas futures prices is observed. However, such growth is insignificant and different from the point of view of quotations for oil and gas futures. However, the classification of such periods is important in conducting overall data analysis.

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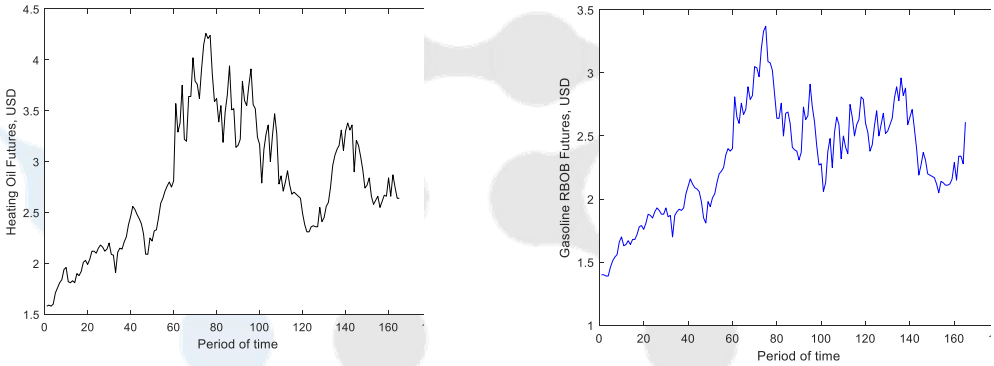
The mutual dynamics of oil and gas futures have some similar elements. This similarity is most typical for the first third of the time period under study. But even during this period of time some differences should be noted. This is most evident in the volatility of the relevant data. Further, differences in the consistency of dynamics in oil and gas futures become more pronounced. Gas futures volatility is increasing. For oil quotes, it should be noted that their futures fell more deeply than the gas futures quotes. This makes it advisable to conduct additional research into the mutual dynamics of such quotes. The importance of such analysis is associated with the possibility of justifying various investment strategies and strategies for entering the stock market. Let's look at this issue in the next section of the article.

Some statistical characteristics of oil (gas) quotes are as follows: kurtosis – 0.203925 (-0.1413); skewness – 0.62551 (0.95382). This confirms the differences in the dynamics of the studied quotations for oil and gas futures. It also substantiates the importance of considering assessments of their mutual dynamics.

Next, let's look at quotes for gasoline and fuel oil futures. These resources can be considered derived from resources such as oil and gas.

Therefore, a joint consideration of such energy resources is justified and interesting from the point of view of the general concept of conducting the corresponding analysis. In Fig. 2 shows the dynamics of quotations for fuel oil and gasoline futures.



a) Fuel oil b) Gasoline

Figure 2: Dynamics of quotes for fuel oil and gasoline futures

First of all, it should be noted that the dynamics of quotes for fuel oil and gasoline futures are in some way similar to the dynamics of quotes for oil and gas futures. This similarity is observed in the first third of the study period.

Further, differences are observed in the dynamics of the corresponding futures quotes. These differences are typical both for the dynamics of quotes for futures for fuel oil and gasoline, and for the dynamics in comparison with futures for oil and gas. The nature of such differences is observed both in the volatility of quote dynamics and in their multidirectionality at individual time intervals. At the same time, some similarity can be noted for individual time periods.

All this highlights the need for more detailed analysis of the relationship between individual segments of the energy market.

Some statistical characteristics of fuel oil (gasoline) quotes are as follows: kurtosis – -0.70889 (-0.57133); skewness – 0.262569 (-0.08027). This confirms the differences in the dynamics of the studied quotations for fuel oil and gasoline futures. It also substantiates the

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importance of considering assessments of their mutual dynamics. Similar conclusions apply to oil and gas data.

The next point of analysis is the study of estimates of the mutual dynamics of the relevant data.

Comparative assessment of the mutual dynamics of quotations on energy market futures

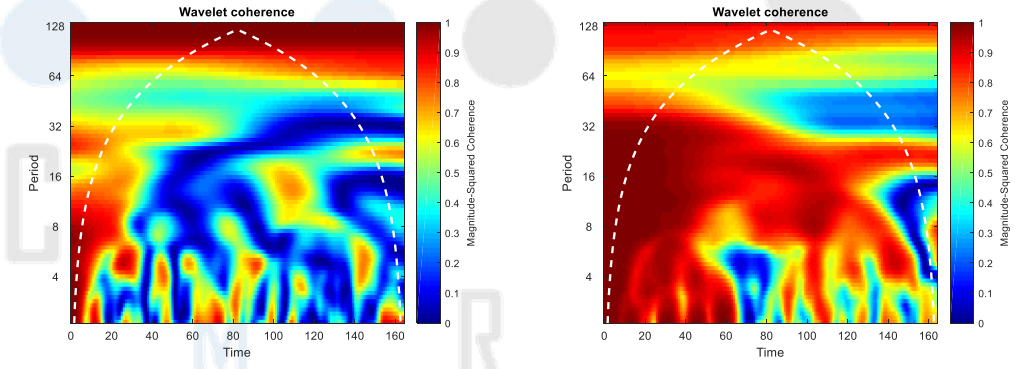
To carry out the corresponding analysis, consider the wavelet methodology. Among such a tool, we should highlight an assessment that is based on wavelet coherence [33]-[35]. This choice is based on the fact that such estimates have found proper application in economic research and work where data are presented in the form of time series [36]-[40].

Such an assessment also makes it possible to evaluate the mutual dynamics of data over the entire interval of their analysis, taking into account individual periods of time. At the same time, here you can study the depth of such relationships, which is important for adopting the necessary investment strategies

In accordance with the chosen research method, we first consider the estimation of wavelet coherence for the data in Fig. 1 and Fig. 2. Then we will analyze the reciprocity in the dynamics of quotes for the futures under study for some cross pairs.

In Fig. 3 presents an assessment of wavelet coherence for data that displays the dynamics of futures for oil and gas, as well as for fuel oil and gasoline.

For the oil/gas pair, it should be noted that the corresponding estimates are fragmentary. Fragmentation is also inherent in the depth of such assessments. This must be taken into account when developing appropriate strategies. For the fuel oil/gasoline pair, a more efficient estimation of wavelet coherence is observed. But over time, such an assessment also becomes fragmented. But this fragmentation is denser compared to the oil/gas pair. This is also an important point when developing investment strategies.



a) Oil and Gas b) Fuel oil and Gasoline

Figure 3: Wavelet coherence estimates for pairs of oil and gas, fuel oil and gasoline

In Fig. 4 presents estimates of wavelet coherence for oil/fuel oil and gas/gasoline pairs.

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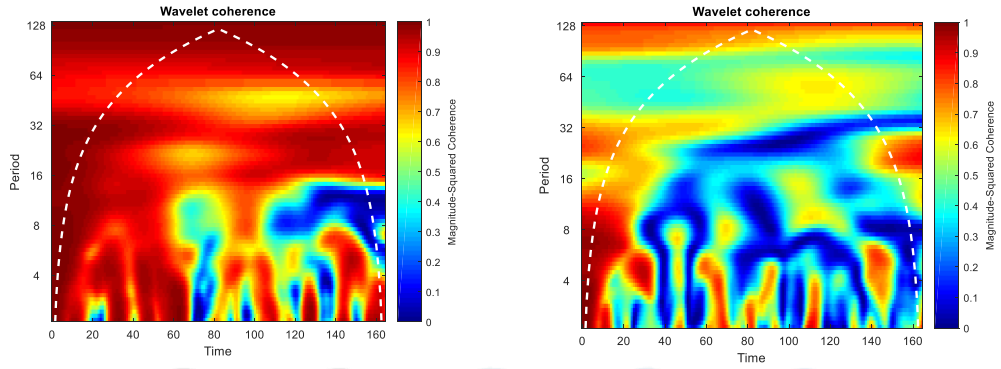

a) Oil and Fuel oil b) Gas and Gasoline

Figure 4: Wavelet coherence estimates for oil/fuel oil and gas/gasoline pairs, respectively

Based on the data in Fig. 4 is visible that the corresponding assessments inherit the relationship between the original and derived types of energy resources. This is also important to consider when developing investment strategies.

Conclusion

The work presents statistical data that allows us to understand the development trends and relationships of individual sectors of the global energy market. For the purpose of appropriate analysis, statistical assessments of such data are considered both in relation to their dynamics and in relation to each other. For the analysis, the dynamics of quotations for oil, gas, fuel oil and gasoline futures were used.

Descriptive statistics and the method of constructing wavelet coherence estimates were used as analysis methods. This allows us to describe the dynamics of the presented data and their relationship, which is important when choosing investment strategies and strategies for entering the stock market.

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