Analysis of the Impact of Crude Oil Futures Price on China's A-share Oil Stock Price Based on Optimized Genetic Algorithms

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Abstract: As the most important raw material in modern production and life, the price trend of petroleum affects the political, military, economic and other aspects of a country. According to the characteristics of stock data, genetic algorithm is designed to analyze the corresponding data model, including gene construction, fitness function selection, genetic strategy operation and related genetic operator design. Through the correlation between crude oil futures price and A-share oil stock price in China, this paper makes a quantitative assessment of China's oil trade risk. The study shows that the model is established to calculate the abnormal return fluctuation of stock prices, based on the event research method and non-parametric test to identify whether there is spillover effect in the short term. Studies have shown that oil diplomacy is actively carried out, and friendly strategic partnerships with oil-producing countries are maintained, diversification strategies are implemented, and oil source concentration risks are dispersed. To mitigate the impact of oil price fluctuations on a country's stock market, the government should choose appropriate policies for different goals.

1. Introduction

Petroleum is the basic energy for the development of modern industrial production. It is called the "blood" of modern industry and plays an important role in the economic development of our country[1]. As the cornerstone of modern capital market, stock market greatly improves the efficiency of resource allocation and the speed of capital accumulation by transferring funds from investors to enterprises. According to the World Energy Agency, the rise in oil prices has further slowed down global economic growth, especially in developing countries [2]. With the increasing volatility of international oil prices, the futures market has gained more attention. At present, the international crude oil futures market has the functions of spot price discovery, risk aversion and speculation regulation [3]. The crude oil futures price not only satisfies the risk management needs of the oil industry for spot, but also regulates the speculative environment of the oil market for speculators [4]. In the complicated stock market, an effective stock market analysis method is urgently needed by investors to help them make the right investment decisions and minimize the investment risk to get the most benefit [5]. Therefore, the research on stock market forecasting methods has important practical significance in theory and practice. Genetic algorithm has broad application prospects in information recognition, analysis and processing. By analyzing the genetic algorithm of coding, an improved genetic algorithm for optimizing the weight of neural network model is presented. And use this model to predict the short-term price of stocks [6]. Based on the existing research, this paper analyzes the causes of international oil price fluctuations and the impact of several oil price fluctuations on major state stocks through theory and facts, revealing the fluctuation of crude oil futures prices and its impact on the stock market [7].

2. Materials and Methods

Petroleum is an important product of imported commodities in China. Because of the particularity of petroleum commodities, most scholars believe that Chinese enterprises have high trade risks in the

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process of petroleum trade, and are faced with such risks as complicated politics of oil source areas, violent fluctuation of crude oil prices and concentration of oil source areas. However, there are many incentives affecting the price trend of A-share oil stocks, and the mechanism is quite complex. At the present stage, it is unrealistic to make a complete and accurate prediction, especially for the immature stock market in China. The existence of artificial manipulation, policy intervention and immaturity of shareholders' psychology have a very negative impact on the formation of prediction. For companies related to oil production, rising oil prices will increase the company's future free cash flow, thereby increasing the company's value and rising stock prices. For companies whose oil is the main raw material, rising oil prices will increase the company's cost and reduce the company's profit margins, leading to a reduction in the company's free cash flow in the future and a decline in stock prices. The correlation coefficient between the A-share oil stock price index is larger than that between the futures price and the A-share oil stock price, indicating that the stock price development trend of China's petroleum industry is consistent, but it is not completely synchronized with the international futures price change. However, the trend of international futures prices and China's oil stock price curve is similar. The weights of various factors of oil trade risk are shown in Table 1.

Table 1 Weight of Risk Factors in Oil Trade

	Weight	Degree
Market risk	15.67%	6.65%
Political risk	53.10%	24.83%
Oil source risk	29.64%	19.34%

An important feature of genetic algorithm optimization process is that it keeps the evolution of the whole population [8] . In this way, even if an individual loses useful characteristics at a certain time, such characteristics will be retained by other individuals and continue to develop, thus having a wide range of applicability. At the same time, it is an intelligent search method using heuristic knowledge. Price fluctuation around value is the manifestation of the law of value. A-share oil stock price is no exception around the fluctuation of value. Therefore, the market price of a stock does not necessarily equal its own value, but its price is determined by its value.Even if it is a partial gene segment that may contain a global optimal solution in its chromosome coding, its reception interval is expanded and extended to [-1.0, 1.0]. That is, if the random function produces a number between [-1.0, 0], the difference solution is unconditionally received. It is also suitable for decision-making problems that cannot be studied quantitatively. Through the analysis of technical means, predict the trend of the entire stock market or individual stocks in the future, and provide decision support for investment. Since the model only contains the current and lag variables in the model and does not contain the current exogenous variables, it is widely used in economic analysis and prediction. The normalized processing data of the A-share oil stock price training samples are shown in Table 2.

Table 2 A-share Oil Stock Price Training Sample Normalization Processing Data

Opening price	Closing price	Trading volume
-0.31030	-0.42322	-0.69413
-0.51341	-0.40210	-0.63121
-0.49212	-0.51061	-0.65310

3. Result Analysis and Discussion

The so-called real economy path refers to the impact mechanism of oil price fluctuation on stock market, which mainly affects a country's stock market through micro-industry and macro-economy. Fluctuations in oil prices can affect the cost of raw materials for companies in related industries, and affect the country's economy and monetary policy through imported inflation. In addition to the influence of domestic and foreign economic factors, there are also human factors controlling the

stock market, so the fluctuation of stock prices is very large. When choosing sample data, we should try our best to choose the period when stock price fluctuates smoothly so that it can objectively reflect the internal law of stock price. Otherwise, once the selected sample is very special, the obtained law does not have universality and cannot reflect the stock price law in other time periods. The coefficients in the model pass the significance test, and the model also passes the stationarity test and is stable. The fitting coefficient is higher, indicating that the model has a better fitting effect. The change in the oil trade price index has a lag, positively affected by the price changes in the previous period, and is the same as the previous period, and is also affected by the opposite direction of international futures prices. Overall, China is a passive recipient of international oil prices. In addition, China's oil companies use financial means to manage price risk awareness is not strong. The lack of experience and practice of price risk management has caused Chinese importers to face greater price fluctuation risks in the oil trade. The conduction path of the exit impact is shown in Figure 1.

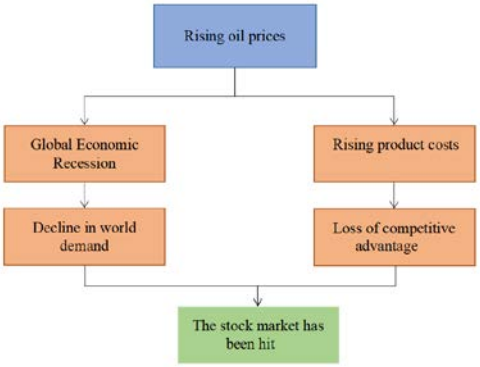

Figure 1 The Conduction Path of Export Shocks

The selection and pretreatment of experimental samples have a great impact on the prediction results of the network model, which is an important problem that must be solved before the model is established. The selected sample data should reflect the trading law of the stock as authentically and objectively as possible, because the stock market is a dynamic process of change. Normal income model is used to estimate normal income model, including statistical model and economic model. The statistical model is based on the statistical assumptions of asset return behavior and does not depend on any economic theory, including mean model and market model. In addition, monetary policy is greatly interfered by the government, and has a certain negative correlation with the changes of the stock market. It is also reasonable to expect that monetary policy can be used as a leading indicator of the changes of the stock market. Both transmission mechanisms have their own characteristics. Therefore, it is also included in the variables of the model. Based on the concept of cointegration, a vector error correction model is proposed. The vector error correction model imposes constraints on variables based on the vector autoregressive model. There is a cointegration relationship between non-stationary variables, then a vector error correction model can be established. In addition, considering the expansion of the company's share capital, that is, the impact of the tradable share capital on the stock price, the tradable share capital is selected as the share capital information of the listed company. At the same time, from a long-term and fundamental perspective, the trend and changes in the stock market are determined by the state's economic development level and economic conditions. Stock market price volatility also largely reflects changes in macroeconomic conditions. The genetic algorithm flow is shown in Figure 2.

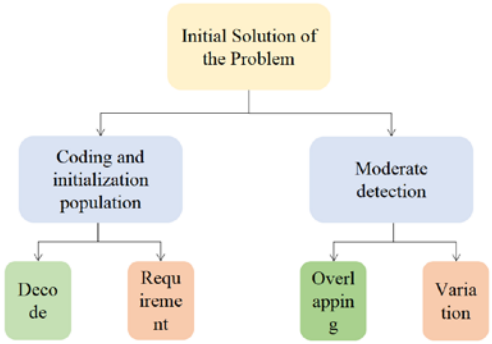

Figure 2 Genetic Algorithms Process

4. Conclusion

As the most important raw material in modern production and life, the price trend of petroleum affects the political, military, economic and other aspects of a country. Oil price fluctuations not only affect a country's macroeconomic performance, but also affect the stock market through a variety of channels. Paying attention to the risks of oil in import trade is not only conducive to the improvement of cost-effectiveness of China's oil enterprises, but also conducive to the stability of China's economy and society. For the prediction of A-share oil stock price, the sample parameters have a great influence on the final prediction results, especially in the period when external factors lead to sharp fluctuations of A-share oil stock price, and sudden external factors will lead to the decline of prediction accuracy. In this paper, aiming at the optimization strategy of genetic algorithm, the performance has been improved, and the prediction accuracy has also been greatly improved. Therefore, the selection of training samples is required in stock types and time periods. Therefore, oil price shocks and tightening monetary policy will have a negative impact on stock prices. The results of the variance decomposition show that over time, the volatility of the Shanghai Composite Index began to be explained more by international oil prices and money supply, interest rates. Therefore, this paper introduces a variety of statistical methods, from the perspective of price, yield, and volatility, the relationship between international crude oil futures prices and China's A-share oil stock prices. It not only proves the long-term causal relationship between international crude oil futures price and China's A-share oil stock price, but also finds the long-term change law between the two market price returns through data mining algorithm. As far as the stock market is concerned, the general sense of non-economic factors, market operations, economic crises, etc., will affect the stock price fluctuations once they occur.

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