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Risk Factors' Analysis on Shanghai Carbon Trading

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Abstract**—**First of all, the carbon trading price and trading volume in Shanghai are transformed by Fourier transform, and the frequency response diagram is obtained. Then, the frequency response diagram is analyzed and the Blackman filter is designed. The Blackman filter is used to filter, and the carbon trading time domain and frequency response diagram are obtained. After wavelet analysis, the carbon trading data were processed; respectively, we got the average value for each 5 days, 10 days, 20 days, 30 days, and 60 days. Finally, the data are used as input of the Back Propagation Neural Network model for prediction.

Keywords**—**Shanghai carbon trading, carbon trading price, carbon trading volume, wavelet analysis, BP neural network model.

JEL codes**—**C53 C58 E37 G17 Q59.

I. Introduction and Literature Review

CARBON emission has resulted in a range of environmental problems and poses a great threat to people's health. Therefore, many countries, through the establishment of carbon finance market, hope to reduce carbon dioxide emissions. However, since the carbon financial market is a complex and nonlinear system, there are many risk factors, so the identification of risk factors, the prediction of carbon trading price and trading volume are very important [1].

The establishment of carbon financial transaction has positive influence on the control of greenhouse gas emissions. However, with more and more financial institutions participating in the market, information asymmetry, policy uncertainty and other risk factors are gradually highlighted, and which have seriously restricted the increase of carbon financial transactions sales. Therefore, how to identify and guard against the risk factors for carbon financial transactions plays a very important role in the long-term development of the carbon finance market [2].

Sihui [1] selected copper fundamentals, industry level and macro level variables, established the prediction model of future copper price based on wavelet transform to the forecast of the copper futures price.

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Li et al. [2] summarized the characteristics for policy risk, credit risk, operational risk, market risk, liquidity risk and project risk. They compared different risk assessment methods, proposed some risk prevention and control suggestions for government and financial institutions.

Zhaodong [3], based on the economic principle of carbon finance development, analyzed the domestic and international carbon finance transaction model, transaction tools and derivative products. In view of the carbon financial market system, they analyzed the risks of the scientific classification market transaction, comparing the risk of price fluctuations in the trading market, made suggestions on the risk and prevention in the carbon financial market.

Tingting et al. [4] took the return rate of China's five carbon emissions trading market as the research object, using different quantile regression model to measure the risk level of the carbon financial market.

Dedong [5] combined with the EU carbon market from 2005 to 2011 closing price of spot and futures data, using GARCH model, DCC-GARCH model, EVT-Copula model, CoVaR index, empirical study on the dependence structure and risk spillover effect of the EU quota spot and futures markets. Based on the actual situation of China, they discussed the establishment of the carbon emission trading market in China.

Yang and Jian [6] choose data from March 2008 to September 2013 CER futures and EUA futures for the sample simulation verification, based on EMD-PSO-SVM, constructing the prediction model of price error correction in international carbon finance market.

Wenting [7] established vector autoregressive model to study the relationship between the future price and spot price of EUA and CER. He made further research on the relationship between quantity and price of carbon futures market, to explore the dynamic relationship between price and volume and position, to guide carbon futures investment.

Fei [8] first analyzed the population size, economic development, energy consumption and carbon emissions in the Yangtze River Delta, and then the DEA model is used to analyze the static efficiency and dynamic efficiency of carbon emissions in 16 major cities in the Yangtze River Delta. Finally, according to the model calculation and analysis results, some suggestions are put forward to improve the environmental efficiency of carbon emissions in the Yangtze River Delta city.

Ming [9] based the analysis of urbanization development and carbon emission level of Shanghai in 1999-2010, the method of cointegration analysis was used to analyze the relationship between urbanization and carbon emissions in Shanghai. To conclude, some suggestions were put forward for the development of urbanization and low carbon economy in

Shanghai.

Yun [10], based on Alfred's equilibrium price theory of Marshall, summarized the laws of foreign carbon emissions trading system by literature research, and divided the driving factors of price fluctuation into two categories: basic factors and unexpected events, found that there is a long-term relationship between price volatility and market fundamentals. Then, took China's carbon emissions trading pilot as a sample, Granger test was used to establish the causal chain between different factors. Finally, the operation rules of domestic and international carbon financial transaction prices are summarized.

II. Wavelet Analysis

Te carbon trading market has typical complexity; there are many factors that affect the risk of carbon market volatility. Wavelet analysis can decompose and reconstruct the signal, it can be observed from coarse to fine, and can be used to segment the translation; at last, it can be divided into the frequency at low frequency, the time division at high frequency, and the adaptive time-frequency signal analysis, so that to focus on any detail of the signal [1].

Wavelet transform is a signal transformation with attenuation and fluctuation. We can also consider the wavelet transform as a set of band-pass filters to filter the signal at different scales. In the application of the real data, the wavelet function used in wavelet analysis is not the only one. The main wavelet functions are Haar wavelet, Daubechies wavelet, Symlet wavelet, Coiflet wavelet, Biorthogonal wavelet and so on.

Wavelet transform has the characteristics of frequency domain and time domain finite support, so it can be used to show the characteristics of local signal in two areas of time domain and frequency domain, to enable us to detect the transient or singular point of the signal.

III. Shanghai Carbon Wavelet Analysis

A. Data Handling

Get the data of carbon trading price and carbon trading volume for every 5 days/10 days/20 days/30 days/60 days. Take the data as the input of BP neural network model, and after the BP network model, finally we get the forecasting data.

B. Wavelet Analysis

Shanghai carbon trading prices and carbon trading volume fluctuate greatly, indicating that the carbon financial market may affected by many risk factors. In order to filter the influence of these risk factors, obtain Shanghai carbon trading prices and carbon trading volume situation in natural state, we use wavelet analysis to filter these risk factors, the specific steps are as in Figs. 1-3.

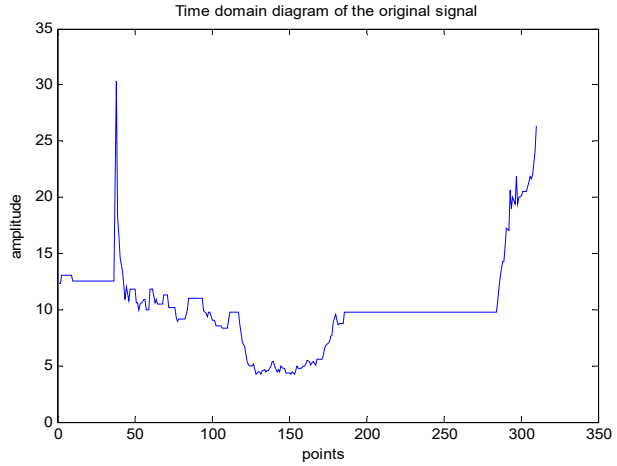

Fig. 1 Shanghai carbon price timing diagram

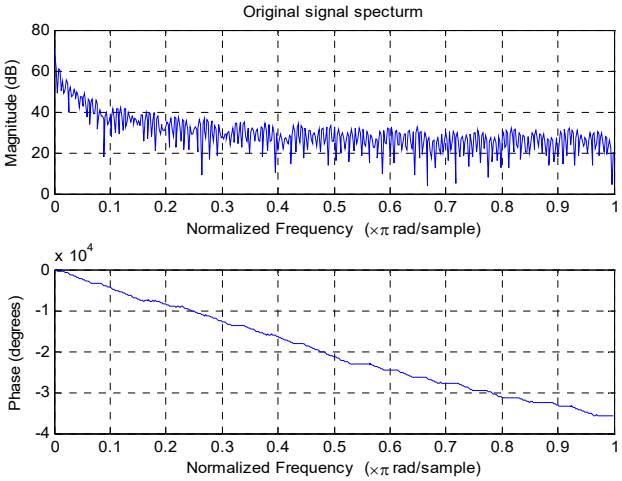

Fig. 2 Shanghai carbon price sequence diagram

C. (一) Shanghai Carbon Trading Price Wavelet Analysis

1. Make Fourier Transform for the Data of Shanghai Carbon Trading Price

First of all, the carbon trading price in Shanghai is transformed by Fourier transform, and the time domain diagram and sequence diagram are obtained.

From Fig. 2, we can see that when the digital angular frequency $w_1 \le 0.1\pi\ rad$, the magnitude of the Shanghai carbon trading price is very high, significantly more than the normal range of fluctuations, this means that the price of carbon trading in Shanghai may be affected by a number of risk factors, such as temperature, policy.

2. Design of Blackman Filter for Risk Factor Filtering

For the carbon price spectrum in Shanghai, after filtering, we get the Shanghai carbon trading price timing diagram and spectrum, as in Figs. 5 and 6.

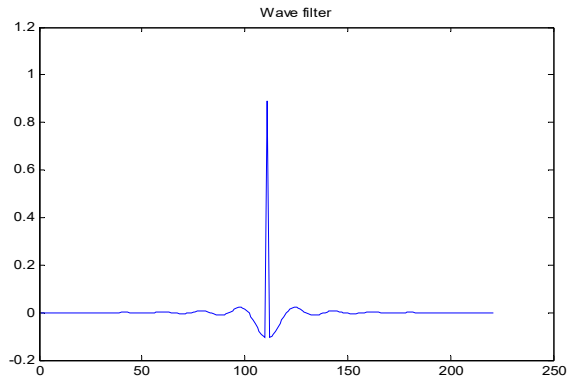

Fig. 3 The Blackman wave filter time domain spectrum

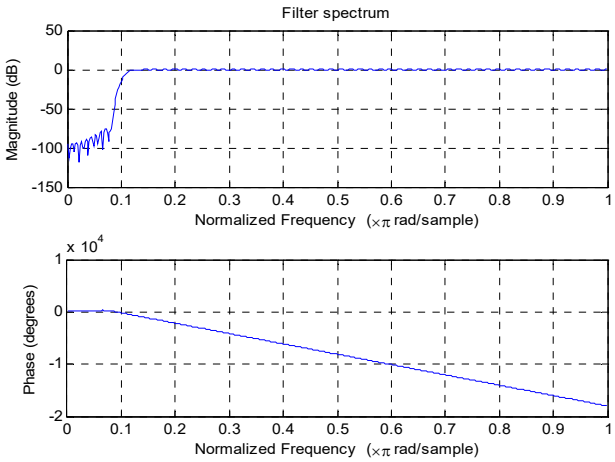

Fig. 4 The Blackman wave filter spectrogram

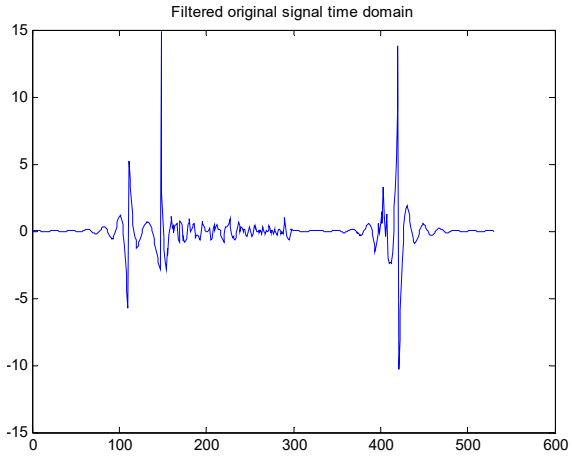

Fig. 5 After filtering Shanghai carbon price timing diagram

D.(二) Shanghai Carbon Trading Volume Wavelet Analysis

In the same way, for the Shanghai carbon trading volume, after the Fourier transform, we can get its timing diagram and amplitude frequency diagram.

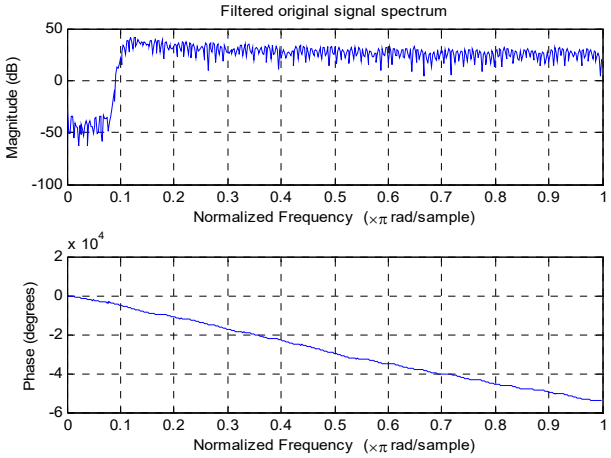

Fig. 6 After filtering Shanghai carbon price spectrum

3. Shanghai Carbon Trading Price Forecasting

Using the Shanghai carbon trading price data after filtering, and bring the filtered carbon trading price data into the BP neural network, we can finally get the shanghai carbon price forecasting data, as in Fig. 7.

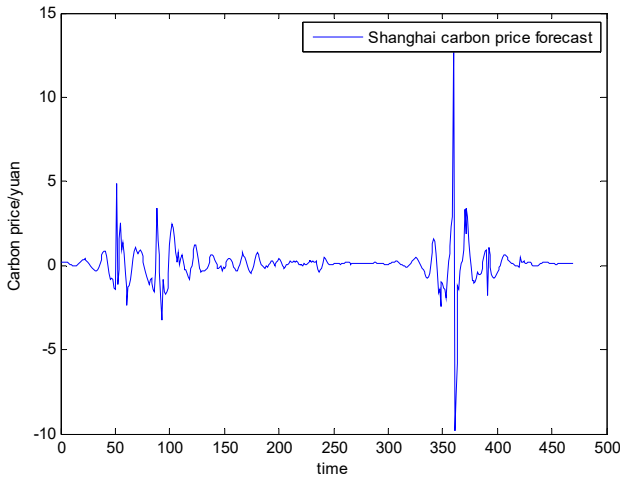

Fig. 7 The final Shanghai carbon price forecasting data

From Fig. 9, we can find when the digital angular frequency $w_2 \le 0.1\pi\ rad$, its magnitude is very high, significantly more than its normal fluctuation range. Therefore, we design the Blackman filter for filtering the risk factors, as in Fig. 10.

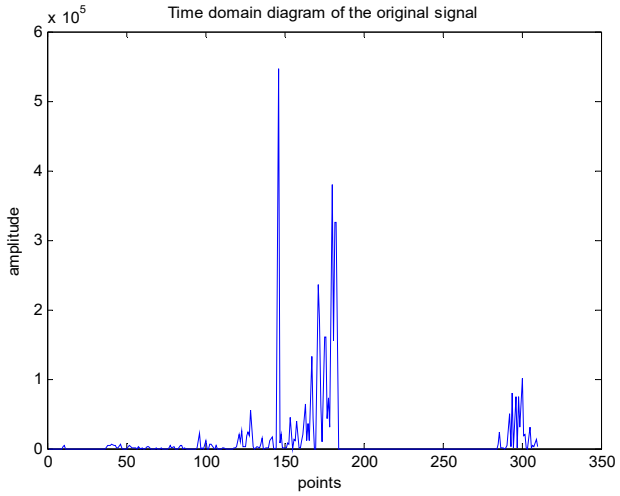

Fig. 8 Shanghai carbon sale time domain diagram

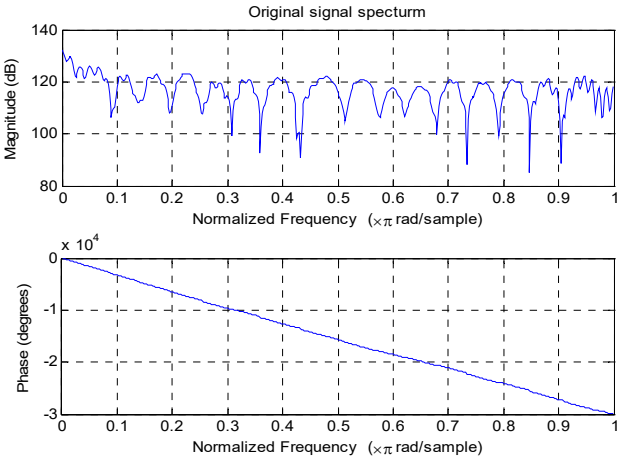

Fig. 9 Shanghai carbon volume spectrum

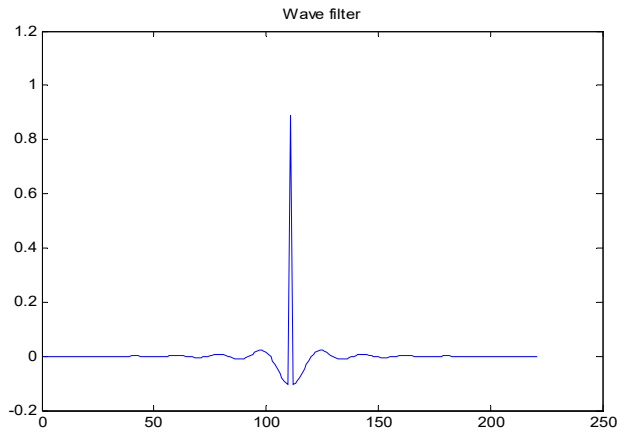

Fig. 10 The Blackman wave filter time domain spectrum

After the filter, we can get the filtered original signal time domain and its filtered original signal frequency spectrum.

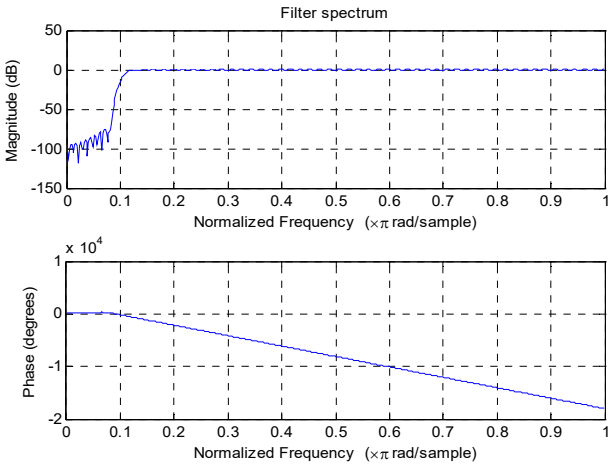

Fig. 11 The Blackman wave filter spectrogram

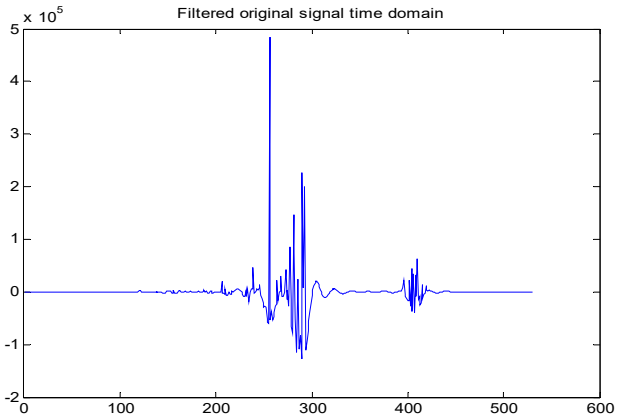

Fig. 12 Shanghai carbon volume filtered original signal time domain

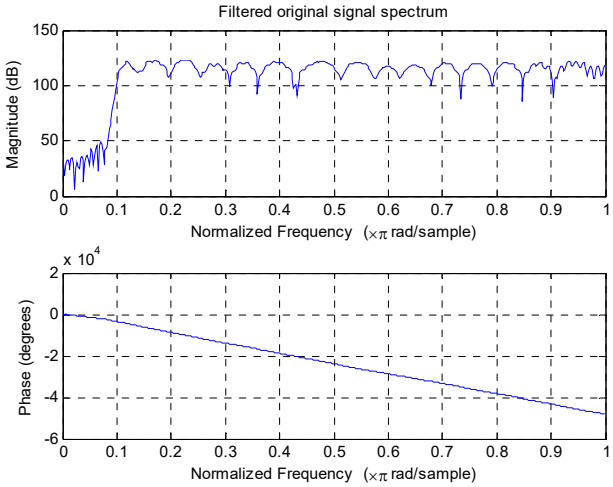

Fig. 13 Shanghai carbon volume filtered original signal frequency spectrum

We put Shanghai carbon trading volume data after filtering out the risk factors into the BP neural network, finally, the forecast value of carbon trading volume in Shanghai is

obtained, as in Fig. 14.

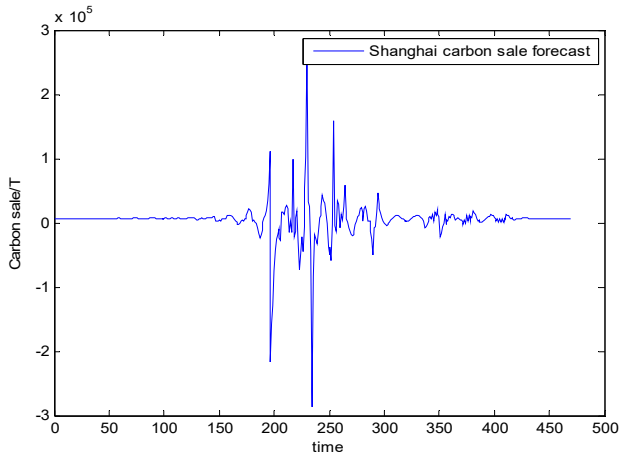

Fig. 14 Shanghai carbon volume forecast

IV. Conclusion

In this paper, the fluctuation of Shanghai carbon trading price and volume are analyzed by wavelet analysis. After filtering, the carbon trading data are resubstituted into BP neural network model, finally, the predicted values of Shanghai carbon trading price and carbon trading volume after filtering risk factors are obtained.

References

[1] Wang Sihui. Analysis of Futures Copper Price Forecast Based on Wavelet Transform (D). Jinan University of Finance, 2015,5.
[2] Du Li, Wang Li, Zhang Yun. Carbon financial transaction risk: Measurement and Prevention (J). Economic Management, vol.36, No.4, Apr., 2014.
[3] Sun Zhaodong. Risks of Trading Market in Carbon Finance and Their Controls in China (D). Ji Lin University, 2015,6.
[4] Wang Tingting, Zhang Yali, Wang Miaohan. A Research on the Risk Measurement of China's Carbon Financial Market (J). Financial Forum, 2016, (9): 57-68.
[5] Zhuang Dedong. A study on the EU carbon market dependence structure and risk spillover effect on price fluctuations of carbon emissions (D). South China University of Technology, 2014,6.
[6] Gao Yang, Li Jian. International carbon finance market price prediction based on EMD-PSO-SVM error correction model (J). China population, resources and environment, vol.24, No.6, 2014, pp: 163-170.
[7] Wang Wenting. Research on price discovery and price-volume relation of European carbon emission market (D). Nanjing University of Aeronautics and Astronautics, 2012, 3.
[8] Wang Fei. Carbon environmental efficiency and influence factors analysis of Yangtze River Delta region based on DEA method. Hefei University of Technology, 2015, 4.
[9] Zhao Ming. The analysis of the impact of urbanization on carbon emission in Shanghai (D). Hefei University of Technology, 2012, 4.
[10] Zhang Yun. The research on price mechanism of carbon financial trading in China (D). Jilin University, 2015, 6.