

Influencing Factors of Coal Price and Its Future Price Forecast

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Abstract: This article used the analytic hierarchy process to analyze the impact of nine factors on coal prices. These factors include nine factors such as the supervision of relevant national departments, national policies, energy consumption, transportation costs, climate change, travel mode, domestic coal market, international coal market, and coal production. In the end, it is concluded that transportation costs and national policies and departmental supervision have the greatest impact on coal prices, and the three factors that have the least impact on coal prices are: the domestic coal market, the international coal market, and the mode of travel. Specifically, the weight of the influence of transportation costs on coal prices is 0.32; the weight of the influence of national policies and departmental supervision on coal prices is 0.22; the weight of the influence of relevant departmental supervision on coal prices is 0.14. According to the forecast model, the coal price will be declining in the next 31 days. In the next 36 months, the coal price will not change much and will continue to fall. After a period of continuous decline, the coal price will usher in an increase. Finally, this article put forward policy recommendations on controlling coal prices.

1 INTRODUCTION

As an upstream industry in the basic industries of the national economy such as electric power and building materials, the status of coal resources and price levels will have a direct impact on the national economy, and the further exploitation and use of coal resources has made its importance increasingly prominent. Looking for the influencing factors of coal prices is to have a deeper understanding of the changes in coal prices. Effective forecasting of coal prices in China is to provide an effective basis for industry construction and scientific decision-making by related departments. Zhang Jianying (2015) uses the VAR model to find that the factors affecting coal prices include commodity prices, macroeconomic prosperity index and coal production in addition to changes in their own prices; Wang Wen, Li Guodong (2016) analyze the influence factors of coal prices from four levels: micro, macro, industry and international market.

Based on this, this paper determines the ten basic influencing factors that affect the price of thermal coal in Qinhuangdao, and uses the analytic hierarchy process to build a comprehensive price forecast model on the basis of element selection to realize a

rational judgment on the trend of coal prices.

2 MATERIALS AND METHODS

2.1 Materials

This article used the thermal coal price data of Qinhuangdao Port from July 3, 2006 to April 30, 2020 to conduct a case study.

2.2 Methods

2.2.1 Hierarchical Analysis

Combining the knowledge learned in economics: value determines price, supply and demand affects the value law of price, this article first defines the first-level indicator that affects coal prices as production cost (C1) and supply and demand (C2), that is, the criterion level. Through reading a large number of documents, this article has summarized 9 secondary indicators that affect coal prices, namely: energy consumption (P1), climate change (P2), regulation by relevant national authorities (P3), national policies (P4), transport costs (P5), mode of

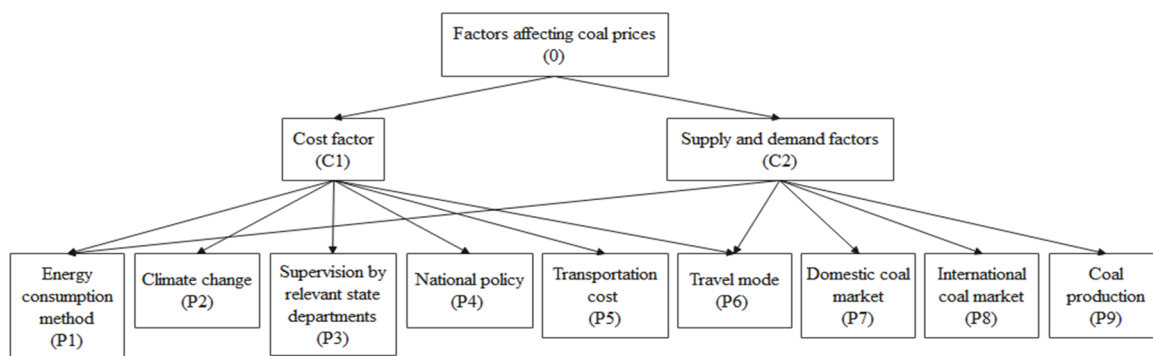


Figure 1: Hierarchical analysis of coal price influencers.

Table 1: Weights that affect coal price factors.

Transport costs(P5)	National policies(P4)	regulation by relevant national authorities (P3)	Coal production (P9)	Energy consumption (P1)	Climate change(P2)	Domestic coal market (P7)	International coal market (P8)	mode of travel (P6)
0.32	0.22	0.14	0.09	0.06	0.06	0.05	0.05	0.01

travel (P6), domestic coal market (P7), international coal market (P8), coal production (P9), that is, the plan level. It is worth mentioning that the primary index is the basic factor that affects the price of coal, and the nine secondary indicators selected affect the price of coal by affecting the primary index. (Zhang, 2005).

2.2.2 Prediction Model Combining Nonlinear Least Squares Method and Fourier Approximation

The nonlinear least squares method is a parameter estimation method that estimates the parameters of the nonlinear static model based on the minimum sum of squares of the error. Where y is the output of the system, x is the input, and θ is the parameter (Wang, 2020). When the fitted function is a linear function to the parameters, this article uses the goodness of fit R-square to evaluate the quality of the fit. It can be seen from the formula that the normal range of the goodness of fit is [0,1]. The closer to 1, the stronger the explanatory power of the variables of the equation to y , and the better the model fits to the data.

First, this paper simplifies the time of the data, assuming that the data for the week represented by each day is assumed to be weekly data, resulting in 671 weeks of data. This article then imports the data into matlab and fits the processed data through the cftool toolbox.

3 RESULTS AND DISCUSSION

3.1 The Weighted Results of The Analytic Hierarchy Process

According to the weight vectors of w_1 , w_2 , and w_3 obtained by the analytic hierarchy process, this article constructed the weight table of P1-P9, and calculated the composite weight of each layer element to the system target through EXCEL, and finally this article got the main factors that affect the coal price:

From the above table, it can be seen that transportation costs, national policies and departmental supervision have the greatest impact on coal prices, and the three factors that have the least impact on coal prices are: domestic coal market, international coal market, and travel mode.

Transportation costs, national policies and departmental supervision have the greatest impact on coal prices. Transportation costs (0.32): transportation costs are a major factor affecting coal prices in China. China's coal transportation mainly has railway transport, road transport, waterway transportation and so on. Among them, railway traffic accounts for more than half of the total traffic, railway traffic will have a greater impact on coal prices. Especially in the case of large demand for coal, the shortage of railway transportation will increase the cost of coal transportation, thus driving up the price of coal (Zhang, 2016). In addition, changes in waterway transport prices can also have

an impact on coal prices (Wang, 2016).

National policy (0.33): the relevant policies issued by the state is an important factor affecting coal prices. Supervision by relevant state departments (0.14): As China's relevant regulatory authorities strengthen supervision of the coal industry, China's coal enterprises to safety systems and safety technology standards are higher, thereby increasing the cost of coal production safety prevention and control.

The three factors that have the least impact on coal prices are: domestic coal market, international coal market, and travel mode. Domestic coal market (0.05): China's domestic coal market directly reflects the supply and demand of coal, will inevitably affect coal prices. International coal market (0.05): With the further development of economic globalization, the change of international coal price is bound to have an impact on domestic coal price. The path of action can be to influence the price of coal by affecting the amount of coal imported and exported. Mode of travel (0.01): People's choice of travel

mode includes car, public transport, walking, etc., which will affect the social demand of the downstream coal industry, thus affecting the demand for coal.

3.2 Prediction Model Combining Nonlinear Least Squares Method and Fourier Approximation

Figure 2 shows that the curve approaching Fourier can roughly fit the data of coal prices over the years. R-square is 0.8234, close to 1, and the fit is good.

3.3 Forecast Trends in Coal Prices Over the Next 31 Days, The Next 35 Weeks and The Next 36 Months

According to the forecast model, this paper obtains the coal price in the next 31 days, the coal price in the next 35 weeks and the trend of coal price change in the next 36 months, as shown in Figures 3, 4 and 5.

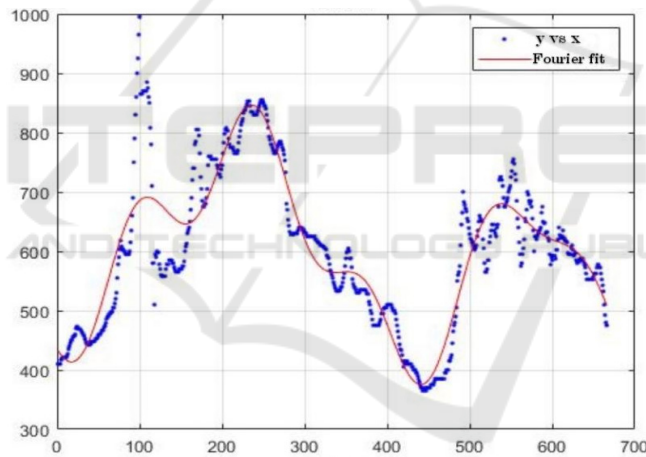


Figure 2: Fourier approximates the prediction model.

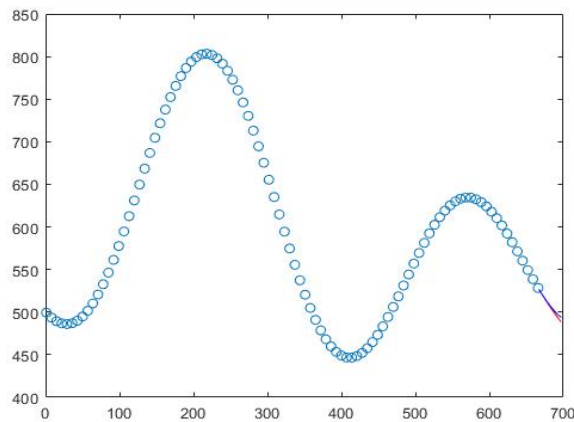


Figure 3: Coal prices for the next 31 days.

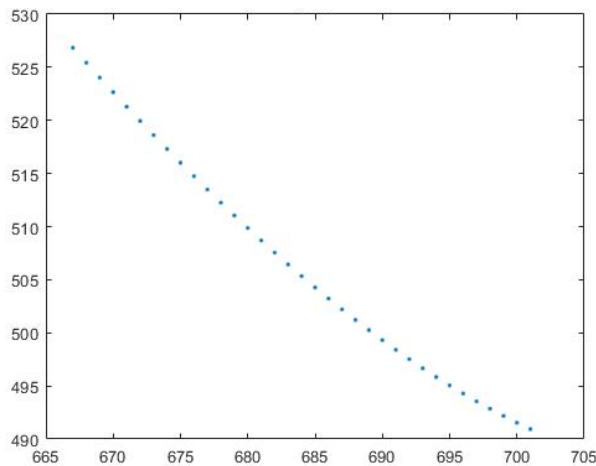


Figure 4: Changes in coal prices over the next 35 weeks.

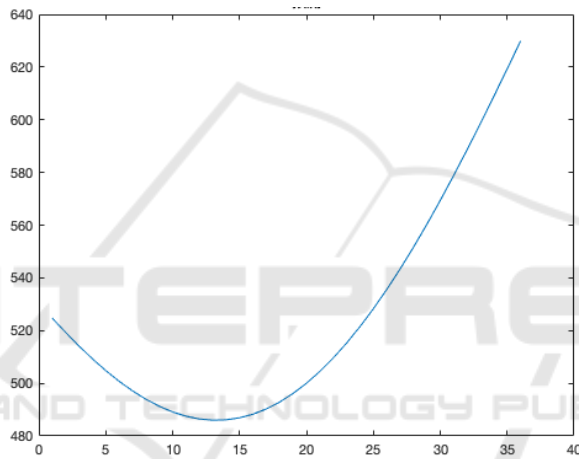


Figure 5: Changes in coal prices over the next 36 months.

According to the forecast model, coal prices are falling over the next 31 days. As the images show, coal prices are falling over time over time, and at a slower rate over the next 35 weeks. Coal prices will not change much in the next 36 months, ushering in growth after a period of sustained decline.

4 CONCLUSIONS

This article used hierarchical analysis to analyze the impact of nine factors on coal prices. These factors include the supervision of relevant state departments, national policies, energy consumption, transportation costs, climate change, mode of travel, domestic coal market, international coal market, coal production nine factors. Finally, it is concluded that transportation costs, national policies and sectoral regulation have the greatest impact on coal prices,

while the three factors with the least impact on coal prices are: domestic coal market, international coal market, and mode of travel. Specifically, the impact of transportation costs on coal prices is weighted at 0.32; the impact of national policies and sectoral regulation on coal prices is weighted at 0.22; and the impact of relevant departments on coal prices is weighted at 0.14. According to the forecast model, coal prices in the next 31 days are falling, coal prices in the coming year is not much change and continue to decline, coal prices after a period of sustained decline, will usher in growth.

Finally, this article put forward policy proposals to control coal prices. First of all, the government adopts a strict control of the import of coal policy, so as to effectively control the impact of the international market on domestic coal prices. Second, the government strengthens supply-side management and strictly controls illegal coal

production. Third, the government adopted policies to stimulate domestic coal demand, thereby promoting a balance between supply and demand. Finally, the government adopts reasonable charges for coal transportation to increase coal transportation capacity, thus stimulating coal consumption.

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