Based on the grey relational model of Zhengzhou logistics demand impact factor study

Mingrui Yue

School of Management Engineering, Zhengzhou University, Science Avenue 100, Zhengzhou, China

Keywords: Zhengzhou city; logistics demand; gray correlation analysis

Abstract: Zhengzhou is the core node city of the 'belt and road'inland region, which plays an important role, and the development of logistics industry is of great significance. Based on the analysis of the influence factors of the development of the logistics industry in Zhengzhou, the paper makes an empirical analysis of the factors affecting the development of the logistics industry in Zhengzhou, and the results show that the total amount of traffic, the value added of the first industry, the turnover of the railway goods, the local fiscal expenditure, the local financial revenue, the total amount of the post and telecommunications business in Zhengzhou, the value added of the secondary industry, the turnover of the tertiary industry. Finally, the corresponding policy suggestions are put forward according to the empirical results.

1. Introduction

The logistics industry is a strategic and basic industry for the development of the national economy, speeding up the development of the logistics industry, which is of great significance to promoting the supply-side structural reform and improving the quality and efficiency of the national economy [1].Through the deployment of the Silk Road economic belt, the Chinese economy has a radiating effect, which has important influence on the neighboring countries. Zhengzhou should focus on building the Silk Road economic belt and trade logistics center as a way to improve logistics facilities and functions, integrate logistics resources and elements, improve logistics operation and service level, and innovate new models and mechanisms for logistics development.

2. Research methods and index system

2.1 Research methods

Grey relational analysis is a method to quantitatively describe the similarity of dynamic changes between variables. It is to calculate the degree of influence between the factors of the system and the contribution of each factor to the main behavior of the system by calculating the grey correlation degree. The basic idea is to judge whether the relationship between sequences is close according to the similarity degree of the curve geometry between sequences [2]. The closer the curve change trend is, the greater the correlation between the corresponding sequences is, and the smaller the vice versa .

2.2 Index system and correlation analysis

2.2.1 Economic development level

The logistics industry, as a logistics support for economic development, has a close relationship with the development and service form of the economy. The structure of regional industries has an indispensable role in the demand for regional logistics. Different industries have different requirements for logistics demand functions and logistics demand levels, which will cause the difference in industrial structure to cause large differences in logistics demand.

  DOI: 10.25236/iwass.2019.044

2.2.2 Government support

The formation of modern logistics centers requires strong financial and policy support, especially the government's financial strength can play a guiding role in the development of port logistics.

2.2.3 Cargo turnover

In measuring the selection of the development level indicators of the logistics industry, the cargo turnover is a direct reflection of the level of logistics development [3]. Cargo turnover refers to the amount of cargo transported by the composite unit (ton-kilometer) of weight and transport distance that is actually completed by various means of transport within a certain period of time.

2.2.4 Social logistics needs

The postal and postal services are also resource resources for logistics development. With the development of e-commerce, online and offline transactions have become more common. With the emergence of online shopping, there is a large demand for logistics. The consumption level and consumption structure of residents have a significant impact on the level of logistics services [4]. This paper identifies the indicator system, as shown in Table 1 .

Table 1 Reference sequence and comparison sequence indicator system

Series	Primary indicator	Secondary indicators	Code	Unit
Reference series	Transportation,warehousing and postal services	Transportation,warehousing and postal services	X0	Billion
	The level of	GDP	X1	Billion
	economicdevelopment	Primary industry added value	X2	Billion
		Second industry added value	X3	Billion
		Third industry added value	X4	Billion
	Government support	Local fiscal revenue	X5	Billion
		Local fiscal expenditure	X6	Billion
Contrast	Cargo turnover	Cargo turnover	X7	Billion tons·km
series		Railway freight turnover	X8	Billion tons·km
		Road cargo turnover	X9	Billion tons·km
		Air cargo turnover	X10	Billion tons·km
	Social logistics needs	Total post and telecommunications business	X11	Ten thousand yuan
		Per capita disposable income of urban households	X12	yuan

3. Empirical research

After confirming the reference sequence and the comparison sequence, the data of Zhengzhou Statistical Yearbook, Zhengzhou National Economic and Social Development Statistical Bulletin, Nanning Statistical Yearbook, Shangqiu Statistical Yearbook, China Statistical Yearbook, Henan Statistical Yearbook, Luoyang Statistical Yearbook and Zhengzhou Municipal Bureau of Statistics are available. The relevant statistical data of Zhengzhou City from 2011 to 2018 were collected, and the index values of X0 and X1-X13 were obtained, and then the gray correlation analysis was carried out according to the steps in Figure 1.

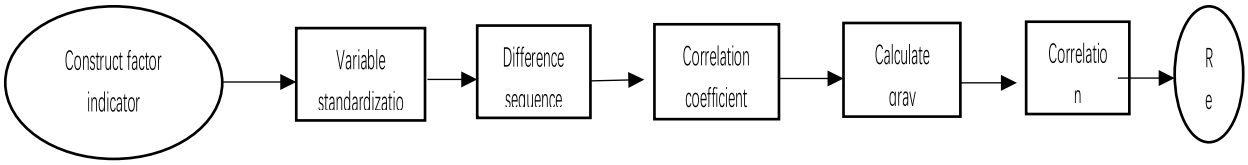

Figure 1 Gray correlation analysis steps

3.1 Constructing the original matrix

According to the raw data of the reference factor and the comparison factor indicator, the matrix is constructed according to the time series:A= $(a_{ij})_{mn}(i = 0,1,2,\dots,14; j = 1,2,3,\dots,8)$. among them, $A_0 = \big(a_0(1), a_0(2), \dots, a_0(8)\big)$ Representation reference factor index sequence [5][6] ;

$A_k = \big(a_k(1), a_k(2), \dots, a_k(8)\big)(k \epsilon N^*)$ Indicates the comparison factor indicator sequence.

3.2 Dimensionless - initial value

Since the original data has a direct impact on the calculation results, in order to unify the evaluation scales of all the indicators, the original indicator sequences need to be quantified. The dimensionless values of the original data are shown in Table 2.

$$\text{Initial value } b_{ij} = \frac{a_{ij}}{a_{i1}}(i = 0,1,2,\dots,14; j = 1,2,3,\dots,8) \quad (1)$$

Table 2 Dimensionless values of raw data

	2011	2012	2013	2014	2015	2016	2017	2018
X0	1.00	1.14	1.28	1.30	1.43	1.53	1.83	2.03
X1	1.00	1.12	1.25	1.36	1.47	1.63	32.26	35.59
X2	1.00	1.03	1.12	1.12	1.15	1.19	0.56	0.52
X3	1.00	1.11	1.21	1.21	1.25	1.32	14.90	15.62
X4	1.00	1.14	1.31	1.59	1.80	2.06	16.58	19.46
X5	1.00	1.27	2.38	2.73	2.95	3.68	7.48	6.68
X6	1.00	1.16	1.44	1.62	1.95	2.33	5.32	6.19
X7	1.00	1.09	1.21	0.95	0.97	1.22	2.73	3.03
X8	1.00	1.00	1.03	0.95	0.82	0.84	0.71	0.75
X9	1.00	1.13	1.32	0.94	1.05	1.40	1.96	2.18
X10	1.00	11.60	9.67	7.83	9.00	24.50	0.07	0.10
X11	1.00	1.04	1.17	1.83	2.55	3.66	1.70	3.69
X12	1.00	1.05	1.23	1.35	1.44	1.54	126.49	136.99

3.3 Find the absolute difference sequence and its maximum and minimum

The absolute difference is the absolute value of the difference between the reference sequence and the corresponding sequence element [7][8], which is recorded asΔ_{0ij}, which is

$$\Delta_{0ij} = \big|b_{0j} - b_{ij}\big|(i = 0,1,2,\dots,14; j = 1,2,3,\dots,8) \quad (2)$$

$$\mathbb{M} = \max_i \max_j \Delta_{0ij} \quad (3)$$

$$\mathbb{m}=\min_i \min_j \Delta_{0ij} \quad (4)$$

3.4 Find the grey correlation coefficient of each point

The gray correlation coefficient refers to the degree of association between the reference sequence and the corresponding sequence element, and is recorded as ξ_{ij} , the correlation coefficient between each comparison series and the reference series is shown in Table 3.

$$\xi_{ij} = \frac{\min\limits_i \min\limits_j \left|b_{0j} - b_{ij}\right| + \rho \max\limits_i \max\limits_j \left|b_{0j} - b_{ij}\right|}{\left|b_{0j} - b_{ij}\right| + \rho \max\limits_i \max\limits_j \left|b_{0j} - b_{ij}\right|} \quad (5)$$

Table 3 Correlation coefficient between each comparison series and reference series

	2011	2012	2013	2014	2015	2016	2017	2018
X1	1	1.0000	0.9999	0.9999	0.9999	0.9998	0.9382	0.9323
X2	1	0.9998	0.9996	0.9996	0.9994	0.9990	0.9973	0.9967
X3	1	0.9999	0.9998	0.9998	0.9996	0.9997	0.9725	0.9714
X4	1	1.0000	0.9999	0.9994	0.9992	0.9984	0.9691	0.9637
X5	1	0.9997	0.9976	0.9969	0.9967	0.9965	0.9879	0.9900
X6	1	0.9999	0.9997	0.9993	0.9989	0.9971	0.9925	0.9911
X7	1	0.9999	0.9999	0.9992	0.9990	0.9976	0.9980	0.9978
X8	1	0.9997	0.9995	0.9992	0.9987	0.9992	0.9976	0.9972
X9	1	1.0000	0.9999	0.9992	0.9992	0.9988	0.9997	0.9997
X10	1	0.9779	0.9822	0.9861	0.9839	0.9524	0.9962	0.9959
X11	1	0.9998	0.9997	0.9989	0.9976	0.9568	0.9997	0.9964
X12	1	0.9998	0.9999	0.9999	1.0000	0.9954	0.7876	0.7740
X13	1	0.9997	0.9993	0.9993	0.9992	0.9992	0.3499	0.3333

3.5 Find the relevance and order of each factor

The total degree of correlation is obtained by reference sequence and comparison sequence correlation coefficient, and the gray correlation degree is calculated by the method of arithmetic evaluation. r_{0i}, which is

$$r_{0i} = \frac{1}{n}\sum_{j=1}^{n} \xi_{ij} \quad (6)$$

Table 4 Ranking of factors related to each factor

index		Correlation	Sort
Road cargo turnover	X9	0.9996	1
Cargo turnover	X7	0.9989	2
Primary industry added value	X2	0.9989	3
Railway freight turnover	X8	0.9989	4
Local fiscal expenditure	X6	0.9973	5
Local fiscal revenue	X5	0.9957	6
Total post and telecommunications business	X11	0.9936	7
Second industry added value	X3	0.9929	8
Third industry added value	X4	0.9912	9
Air cargo turnover	X10	0.9843	10
GDP	X1	0.9838	11
Per capita disposable income of urban households	X12	0.9446	12

3.6 Analysis of empirical results

Through the above analysis Table 4, it can be seen that the ranking of each influencing factor is related. In addition to the low number of ordinary undergraduate graduates, the correlation value of the other 12 influencing factors are relatively high, both above 0.9446 and above, indicating that these factors have a great impact on the development of Zhengzhou logistics industry.

4. Suggestions for promoting the development of Zhengzhou logistics

4.1 Optimize the industrial structure, economically pull the animal stream

Zhengzhou is one of China's textile industrial bases and an important metallurgical building material industrial base in China. The development of industry has greatly promoted the development of logistics. In the future development of Zhengzhou, we must vigorously support industrial construction, optimize the industrial structure, and promote the sound development of the economy [9][10].

4.2 Strengthen organizational leadership and increase government support

The correlation between fiscal expenditure, fiscal revenue and logistics in Zhengzhou City is 0.9973 and 0.9957, respectively, indicating that the logistics development of Zhengzhou City is largely inseparable from the strong support of the state and local governments[11]. Policy "One Belt, One Road" is the foundationIn the trade road formed by international cooperation, Zhengzhou logistics industry must take this opportunity to achieve strategic development, it must have a continuous and perfect support policy.

4.3 Give play to the advantages of road network and promote logistics development

It can be seen that road transportation is the backbone of the development of Zhengzhou's logistics industry. In the future development of logistics, Zhengzhou should strengthen its support for road transportation, improve the road transportation network, adopt a scientific and effective form, reduce the vacancy rate of trucks, and carry out reasonable transportation. In terms of railway transportation, Zhengzhou should rely on railway transportation to carry out multimodal transport of public, iron, sea and air, optimize the transshipment process of goods, simplify the procedures for entering and leaving the station, and improve transportation efficiency [12][13]. In terms of air transportation, Zhengzhou City should strengthen the construction of air cargo information system, improve the efficiency of cargo clearance, and improve the international freight route network.

4.4 Optimize consumption structure and improve logistics quality

With the improvement of people's income level, after satisfying the basic survival needs of clothing, food, housing and transportation, people have a higher pursuit of living environment, and high-end consumption and commodity consumption have increased. In order to comply with the improvement of residents' consumption level and the change of consumption structure, Zhengzhou City should optimize the layout of urban and rural logistics centers, establish modern logistics concepts, actively introduce modern logistics facilities, do a good job of “last mile” cargo distribution, strengthen logistics information construction, and apply modern Information system, strengthen the management of urban and rural logistics chain, and achieve high efficiency and high efficiency of urban and rural logistics distribution [14].

Acknowledgements

Fund Project: Zhengzhou City Science and Technology Bureau Zhengzhou City Science and

Technology Progress Contribution Rate Analysis Research (2019RKXF0029)

References

[1] Xu Jingyan. Grey relational analysis of urban and rural logistics and economic development in anhui province. Journal of Anhui Vocational and Technical College, 2018, 17(03):25-28.

[2] Yue Yunkang, Jiao Liqin, Gao Pingtang. Analysis of grey correlation between shanxi logistics and economy. Economic Issues, 2017(07):121-124.

[3] Yan Shuangbo. Analysis of Grey Correlation Degree between Logistics Industry and Its Main Economic Impact Factors in Three Major Regions of China. Journal of Quanzhou Normal University, 2016, 34(02): 84-91.

[4] Li Jinfeng. Analysis of grey correlation degree between logistics industry and economic development in henan province. Shang, 2015(26):249-250.

[5] Zhang Lin, Dong Qianli, Shen Liang. Research on the coordinated development of logistics industry and regional economy in node cities——based on national panel data of logistics node cities. East China Economic Management, 2015, 29(02):67- 73.

[6] Zhai Fang. Influencing factors and prediction of rural logistics demand in Jiangxi Province [D]. East China Jiaotong University, 2018.

[7] Block Heming. Analysis of the factors affecting China's agricultural product logistics based on grey correlation degree. Hebei Enterprise, 2018(12):107-109.

[8] Xu Wei. Agricultural product logistics and its influencing factors in Shaanxi Province based on grey correlation analysis. Liaoning Agricultural Sciences, 2019, (04): 26-28.

[9] Geng Luqing, Huang Peihua. Study on the demand of cold chain logistics of fruits and vegetables in guangxi and its influencing factors based on grey theory. China Agricultural Resources and Division, 2017, 38(12):227-234.

[10] Wang Jiang, Zhu Xiaotong. Research on the factors affecting the development of logistics industry in xinjiang from the perspective of silk road economic belt. Xinjiang Land Reclamation Economy, 2018(04): 64-70.

[11] Bi Huan, Fu Yu, Chen Yijun, Han Bing, Wang Junxiang. Analysis of the influence of logistics demand in chenzhou city based on principal component regression model. Journal of Sichuan University of Science and Technology (Natural Science), 2018, 31(01):93 -100.

[12] Wang Shengchang. Logistics demand forecasting system based on grey neural network and its application [D]. Beijing University of Technology, 2017.

[13] Lin Wei. Grey correlation analysis of the influencing factors of qingdao port logistics——in the background of ‘one belt and one road’. China Business Theory, 2018(20): 12-15.

[14] DOU Jin. Analysis of factors affecting logistics demand in gansu based on grey correlation model——in the background of the belt and road initiative. Logistics Engineering and Management, 2017, 39(02):47-50.