Electricity- economy Correlation Analysis of New Kinetic Energy Industry Based on Grey Theory

Chaoyuan Li[1], Yongqi Yang[2, a, *], Wanlei Xue[2]

[1]School of Finance, Shanghai University of Finance and Economics, Shanghai, China

[2]Economic and Technology Research Institute, State Grid Shandong Electric Power Company, Jinan, China

[a]yangyongqincepu@163.com

*Corresponding author

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Abstract: At present, "new normal" is widely used for China's economic development, thus the economic growth has gradually changed from high-speed growth to medium high-speed growth. The key point to further promote China's economic construction is to give full play to pull effect of new kinetic industries on economic growth and improve the quality of economic development. Based on the grey theory, this paper constructs a correlation analysis model, studies the correlation between the economic growth and electricity consumption growth of each new kinetic energy industry, analyses the contribution of each new kinetic energy industry to economic growth, and provides a scientific basis for the government's policy making.

1. Introduction

At present, "new normal" is widely used for China's economic development, thus the economic growth has gradually changed from high-speed growth to medium high-speed growth. The transformation of new and old kinetic energy industry is a major strategic measure to realize innovation driven and promote the economic development from high-speed growth to high-quality development. From the perspective of the world, the transformation of new and old kinetic energy is not only the objective law of the world economic evolution, but also the inevitable requirement of the sustainable development of the new technological revolution. From the perspective of domestic development, the transformation of new and old kinetic energy industry is the fundamental way for China to move towards the new era of economic development.

2. The Grey Correlation Analysis Model

The grey relational degree model can be built using index data matrix:

$$A=\begin{pmatrix} X_{11} & X_{12} & \cdots & X_{1n} \\ X_{21} & X_{22} & \cdots & X_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ X_{m1} & X_{m2} & \cdots & X_{mn} \end{pmatrix} \tag{1}$$

The model can be calculated as follows:

1) Core index data collecting and form the core index data vector:

$$X_0=(X_{01},\ X_{02},\ \ldots,\ X_{0n}) \tag{2}$$

2) Index data normalization:

The normalization process in this paper was carried out using averaging method to remove the dimensional difference between indexes:

$$X'_{jk} = \frac{X_{jk}}{\frac{1}{m}\sum_{j=1}^{m} X_{jk}} \tag{3}$$

3) D-value calculation

D-value calculation between every index and core index:

$$|X'j0\text{-}X'jk| \tag{4}$$

Maximum and minimum D-value calculation:

$$\min_{j=1}^{m}\min_{k=1}^{n}\left|X'_{j0} - X'_{jk}\right| \tag{5}$$

$$\max_{j=1}^{m}\max_{k=1}^{n}\left|X'_{j0} - X'_{jk}\right| \tag{6}$$

4) Grey relational degree calculation

The grey relational degree coefficient between every index and core index should be calculated using formula (7):

$$\theta_{jk} = \frac{\min\limits_{j}\min\limits_{k}\left|X'_{j0} - X'_{jk}\right| + \lambda \max\limits_{j}\max\limits_{k}\left|X'_{j0} - X'_{jk}\right|}{\left|X'_{j0} - X'_{jk}\right| + \lambda \max\limits_{j}\max\limits_{k}\left|X'_{j0} - X'_{jk}\right|} \tag{7}$$

λ represents distinguishing coefficient, of which data range is (0,1). In this paper, we decide the value of λ is 0.5

The average value of grey relational degree coefficient should be calculated using formula (8) and obtain the grey relational degree of each index:

$$E = \frac{1}{n}\sum_{j=1}^{n}\theta_{jk} \tag{8}$$

3. Example analysis

In this paper, we use the GDP growth of a province in North China (2018 and the first three quarters of 2019) and the electricity growth new energy industry to analyze their positive effect to GDP growth.

Table 1. Indexes and data

Indexes	2018 1st quarter	2018 2nd quarter	2018 3rd quarter	2018 4th quarter	2019 1st quarter	2019 2nd quarter	2019 3rd quarter
GDP growth/%	7.7	7.6	7.5	7.4	7.5	7.4	7.4
New generation of information technology /%	5.2	5.0	8.2	6.2	6.4	6.0	6.2
High-end equipment /%	6.8	7.1	5.3	6.5	5.4	5.5	5.9
New energy and new materials/%	7.2	7.0	5.2	5.0	6.5	6.5	6.4
Smart ocean technology /%	3.3	3.6	2.1	3.0	3.2	3.0	3.0
Health care/%	2.2	2.1	3.6	2.8	3.0	3.5	3.2
Green chemistry /%	4.0	3.6	3.7	3.8	3.2	3.3	3.0
Modern efficient agriculture /%	2.6	2.1	2.4	2.3	2.5	2.6	2.6
Cultural and creative industries /%	6.6	5.6	7.7	6.5	6.2	6.0	5.4
Characteristic tourism/%	5.2	5.8	5.6	5.8	5.2	5.2	5.0
Modern finance /%	1.0	1.2	1.6	1.2	1.0	0.8	0.9

After the data normalization, then again the D-value between core indexes and other indexes can be calculated though formula (4). Among them, the index with the largest D-value is the difference between modern finance and GDP growth (the third quarter of 2018), which is 0.455. Besides, the index with the smallest D-value is smart ocean technology (the 4th quarter of 2018) of which values 0.004.

Correlation coefficient between different indexes is shown in Table 2.

Table 2. Correlation coefficient

Indexes	2018 1st quarter	2018 2nd quarter	2018 3rd quarter	2018 4th quarter	2019 1st quarter	2019 2nd quarter	2019 3rd quarter
New generation of information technology	0.216	0.223	0.258	0.194	0.194	0.193	0.194
High-end equipment	0.199	0.213	0.210	0.205	0.207	0.204	0.193
New energy and new materials	0.205	0.204	0.219	0.226	0.195	0.199	0.197
Smart ocean technology	0.194	0.217	0.251	0.191	0.198	0.191	0.191
Health care	0.236	0.244	0.233	0.195	0.193	0.232	0.210
Green chemistry	0.203	0.188	0.197	0.207	0.203	0.198	0.214
Modern efficient agriculture	0.190	0.213	0.191	0.198	0.192	0.204	0.204
Cultural and creative industries	0.188	0.207	0.231	0.198	0.191	0.196	0.213
Characteristic tourism	0.194	0.196	0.194	0.205	0.194	0.194	0.201
Modern finance	0.204	0.199	0.300	0.209	0.204	0.242	0.221

Grey correlation coefficient of every indexes can be calculated through formula (8) and shown in Table 3.

Table 3. Grey correlation coefficient

Indexes	Grey correlation coefficient
New generation of information technology	0.210
High-end equipment	0.205
New energy and new materials	0.206
Smart ocean technology	0.205
Health care	0.220
Green chemistry	0.202
Modern efficient agriculture	0.199
Cultural and creative industries	0.203
Characteristic tourism	0.197
Modern finance	0.225

As it’s shown in the results, among the these new kinetic energy industries, the electricity growth rate of modern finance has the highest correlation with the growth rate of GDP, reaching 0.225, followed by 0.220 of health care industry and 0.210 of new generation of information technology. Besides, the gray correlation of the other indicators remains between 0.197-0.206.

To sum up, considering the development process of China's society and finance system, the modern finance industry will gradually become one of the driving forces for economic and social development in the future. As for the key research object province in this paper, the future policies and funds should be appropriately transferred to modern finance industry, while focusing on the health care industry and new generation of information technology, and gradually enlarge their positive effect of economic development.

4. Conclusion

In conclusion, China's economy has turned into a stage of high-quality development, and it is undoubtedly a hot spot and key point of national economic development to promote the transformation of new and old kinetic energy and the construction of a modern economic system. Based on the grey theory, this paper constructs a grey correlation analysis model. By calculating the correlation between GDP growth rate and power consumption growth rate of key industries, it analyzes their positive effect of key industries on economic growth. This paper takes a province in North China as an example to carry out empirical calculation. It can be concluded from the analysis that the development of modern finance industry, health care industry and new generation of information technology should be further promoted in this province.

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