Evaluation of Urban Energy Conservation and Emission Reduction Efficiency in Huaihe River Economic Belt

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Abstract

In order to measure the Huaihe river economic belt is the general characteristics of energy conservation and emissions reduction and regional differences, using 2010-2016 panel data of Huaihe river economic belt in 21 cities, using the super efficiency SBM model and Malmquist index method, to detect the relative efficiency of Huaihe river economic belt city energy conservation and emissions reduction, on the basis of the analysis of its static characteristics and dynamic changes of energy conservation and emissions reduction.The results show that the overall efficiency of energy conservation and emission reduction in the Huai river ecological economic belt is effective during the study period, and the level of energy conservation and emission reduction is constantly improved in the fluctuation.There are differences in energy conservation and emission reduction efficiency between different cities. Cities along the Huai river in jiangsu province have higher energy conservation and emission reduction efficiency, while cities along the Huai river in anhui and henan province have lower energy conservation and emission reduction efficiency.From the perspective of total factor energy saving and emission reduction efficiency, the energy saving and emission reduction efficiency of cities in Huaihe river economic belt mainly depends on technological progress.

Keywords

Huai river economic belt, Energy conservation and emission reduction efficiency, Superefficient SBM model, Malmquist index method.

1. Introduction

The Huai river ecological economic belt covers an area of 280,000 square kilometers, including jiangsu, anhui, shandong, henan and hubei provinces, with a population of about 180 million.In November 2018, the state council officially approved the development plan for the Huaihe river ecological economic belt, which proposed to make the Huaihe river ecological economic belt a demonstration belt for the construction of ecological civilization in the river basin.

At present, the serious water pollution in the Huaihe river basin, the worrying water environment, the discharge of air pollutants, the deterioration of air quality and the discharge of solid waste which endangers public safety have all seriously restricted the realization of the goals of the plan. It is urgent to intensify the task of energy conservation and emission reduction. "11th five-year plan" in China for the first time put forward the energy conservation and emissions reduction as a binding forces, "twelfth five-year" further puts forward higher index constraints on energy conservation and emissions reduction, in 2016 the State Council issued by the "work" much starker choices-and graver consequences-in "comprehensive energy conservation and emissions reduction plan" put forward the following goals: by 2020, the country's ten thousand yuan GDP energy consumption is 15% lower than in 2015, the total energy consumption control within the 5 billion tons of standard coal, the sulfur dioxide emissions decreased by 15% respectively in 2015, the total emissions of volatile organic compounds decreased by more than 10% than in 2015. By putting forward hard targets for energy conservation and emission reduction at the national level, it has played a normative and leading role in the work of energy conservation and emission reduction in various regions and localities.

Therefore, in the light of the Huaihe river economic belt in 2010-2016 to evaluate the efficiency of energy saving and emission reduction, energy conservation and emissions reduction efficiency analysis during the Huaihe river economic belt, provide the basis for the Huaihe river economic belt further enhance energy efficiency, to promote the Huaihe river basin ecological civilization construction and promote the sustainable and healthy economic and social development is of great significance, but also measure the efficiency of energy saving and emission reduction for other areas to provide the reference.

2. Literature review

At present, in the efficiency of energy conservation and emissions reduction measure and evaluation method, most scholars focus on framework based on total factor method to evaluate the efficiency of energy saving and emission reduction, this method is based on the theory of total factor production, can effectively inspect the production process of the trade-off between inputs, can have a better grasp the connotation of the energy conservation and emissions reduction.

As for the selection of theoretical methods for efficiency evaluation, data envelopment analysis (DEA) is the most widely used method. DEA method does not need to assume the form of production function, takes into account the technical inefficiency, and can decompose the total factor productivity.Guo bin et al. (2012) selected the input-oriented super-efficiency DEA model to calculate the energy conservation and emission reduction efficiency of six provinces in central China. Li ke et al. (2013) selected the super-efficiency DEA model when evaluating the interprovincial energy conservation and emission reduction efficiency in China. Gu yingwei et al. (2013) built an index system to evaluate the efficiency of energy conservation and emission reduction in liaoning province based on the DEA super-efficiency model.Zhang xuemei et al. (2018) evaluated the energy conservation and emission reduction efficiency of 30 provincial capital cities in China by using the super-efficiency SBM model.Wu chuanqing et al. (2015) selected the super-efficiency DEA model and ML index to evaluate the energy efficiency of the Yangtze river economic belt.Deng shanshan et al. (2016) selected a three-stage DEA model to peel off environmental factors and measure China's interprovincial energy saving and emission reduction potential.Sun xin et al. (2012) used dea-malmquist index to evaluate the energy conservation and emission reduction efficiency in Chinese provinces.Wang weiguo et al. (2012) used the malmquist-luenberger index to analyze the regional total factor energy efficiency in China.Tian ze et al. (2019) used the global malmquist-luenberger index to evaluate the energy conservation and emission reduction efficiency of urban agglomerations in the Yangtze river delta.Li jinkai et al. (2012) used dea-malmquist index to calculate China's inter-provincial total factor energy efficiency.

To sum up, from the perspective of the research scope, most scholars pay more attention to the research on energy conservation and emission reduction efficiency at the national, provincial and provincial capital level, while there are few studies on the level of river basin city belt, especially the rare evaluation on the energy conservation and emission reduction efficiency of the Huaihe river economic belt.From the perspective of research methods, most scholars use one or two theoretical model methods to evaluate the efficiency of energy conservation and emission reduction. In view of this, this article is based on super efficiency SBM model and Malmquist index method, considering the economic development, energy consumption and environmental pollution, etc., construction of Huaihe river economic belt city efficiency evaluation index system, energy saving and emission reduction measures of Huaihe river economic belt city energy conservation and emissions reduction efficiency levels, study of efficiency of Huaihe river economic belt, regional differences and trends, and puts forward countermeasures and Suggestions in improving the efficiency of regional energy conservation and emissions reduction.

3. Model building

3.1 Super-efficiency DEA model

The DEA model was first proposed by a.harnes, w.w.cooper and e.hodes to evaluate the relative effectiveness between departments.When evaluating DMU (DMU for short), traditional DEA evaluation results may show that multiple DMU are DEA effective, but these effective DMU cannot be compared with each other. In order to further investigate the efficiency problem between effective DMU, later researchers improved it, and the improved model was called super-efficiency DEA model. Banker Gifford first proposed the super-efficiency DEA model, whose basic idea is the exclusion mechanism. In other words, when evaluating the efficiency of the ith DMU, the linear combination of the input and output of the other DMU should be used to replace the input and output of the ith DMU.

There are two kinds of super-efficiency DEA models: radial super-efficiency and non-radial super-efficiency. The radial superefficiency reduces the input or expands the output in the same proportion in the calculation of the relaxation, but in the practical application, it does not change in the same proportion, and the radial model will make the results appear deviation, while the non-radial superefficiency takes the relaxation into account in the calculation of the efficiency, and this problem is improved. Therefore, this paper chooses the super-efficient SBM model. The form is as follows:

$$\min \rho_{se} = \frac{1+\frac{1}{m}\sum_{i=1}^{m} s_i^- / x_{ik}}{1-\frac{1}{s}\sum_{r=1}^{s} s_r^+ / y_{rk}}$$

$$\text{s.t.} \begin{cases} \sum_{j=1, j\neq k}^{n} x_{ij}\lambda_j - s_i^- \le x_{ik}, (i=1,2,\cdots,m) \\ \sum_{j=1,\ j\neq k}^{n} y_{rj}\lambda_j + s_i^+ \ge y_{ik}, (r=1,2,\cdots,s) \\ \lambda_j \ge 0 \ \ j=1,\cdots,n; j\neq k \ \ s_i^-, s_r^+ \ge 0 \end{cases}$$

Where: represents the value of relative efficiency; ρ_{se} x_i Represents the input variable; y_r Represents the output variable; m,s Is the number of input index and output index respectively; s_i^-, s_r^+ Represents the slack variables of input and output respectively; λ_j Represents the weight of the index. When, the DMU is relatively effective; $\rho_{se} \ge 1$ At that time, it showed that the DMU was relatively ineffective and needed to improve the input and output accordingly. $\rho_{se} < 1$

3.2 Malmquist index method

The mathematical form of Malmquist index is as follows:

$$\begin{aligned} & M_i(x_i^{t+1}, y_i^{t+1}; x_i^t, y_i^t) \\ & = \left[\frac{D_i^t(x_i^{t+1}, y_i^{t+1})}{D_i^t(x_i^t, y_i^t)} \times \frac{D_i^{t+1}(x_i^{t+1}, y_i^{t+1})}{D_i^{t+1}(x_i^t, y_i^t)}\right]^{\frac{1}{2}} \\ & = \frac{D_i^{t+1}(x_i^{t+1}, y_i^{t+1})}{D_i^t(x_i^t, y_i^t)}\left[\frac{D_i^t(x_i^{t+1}, y_i^{t+1})}{D_i^{t+1}(x_i^t, y_i^t)} \times \frac{D_i^t(x_i^t, y_i^t)}{D_i^{t+1}(x_i^{t+1}, y_i^{t+1})}\right]^{\frac{1}{2}} \end{aligned}$$

Among them, is the technical progress index (TECH), is the comprehensive technical efficiency index (EFFCH). $\frac{D_i^{t+1}(x_i^{t+1},y_i^{t+1})}{D_i^t(x_i^t,y_i^t)}\left[\frac{D_i^t(x_i^{t+1},y_i^{t+1})}{D_i^{t+1}(x_i^t,y_i^t)}\times\frac{D_i^t(x_i^t,y_i^t)}{D_i^{t+1}(x_i^{t+1},y_i^{t+1})}\right]^{\frac{1}{2}}$ If the Malmquist index is greater than 1, it indicates that the efficiency of energy conservation and emission reduction in the current period is higher than that in the previous period, and the energy conservation and emission reduction are progressing.

4. Index system and data source

4.1 Construction of indicator system

The construction of the index system should be scientific and objective, which can not only reflect the specific situation of energy conservation and emission reduction, but also ensure the availability of the index data.In order to systematically and effectively evaluate the efficiency of energy conservation and emission reduction, this paper constructs the following energy conservation and emission reduction indicator system, as shown in table 1.

Table 1 indicator system

The index type	Index selection	unit
Input indicators	Total investment in fixed assets	One hundred million yuan
	Number of employees at the end of the year	Ten thousand people
	Energy consumption per unit of GDP	Tons of standard coal/ten thousand yuan
	Industrial effluent discharge	Ten thousand tons
	Industrial sulphur dioxide emissions	Ten thousand tons
	Industrial smoke (powder) dust emissions	Ten thousand tons
Output indicators	Gross regional product	One hundred million yuan
	Comprehensive utilization rate of industrial solid waste	%

4.2 Data sources

This article selects the Huaihe river economic belt prefecture level or above 21 cities as the research object, involving three provinces, anhui, jiangsu and henan respectively, bengbu, Huainan, fuyang, luan, bozhou, suzhou, Huaibei, chuzhou, Huaian, yancheng and suqian, xuzhou, lianyungang, yangzhou, taizhou, xinyang, zhumadian, zhoukou, luohe, shangqiu, pingdingshan.Considering the availability of statistical data of different indicators in each city, the panel data of 21 cities in the Huai river economic belt from 2010 to 2016 were used as samples for the study.The data used for the relevant indicators are mainly from the statistical data of China's urban statistical yearbook and the statistical yearbook of various cities.

5. Empirical analysis

5.1 Analysis of the results of energy conservation and emission reduction

In this paper, the super-efficiency SBM model from the perspective of investment is adopted to calculate the energy saving and emission reduction efficiency value of each city based on the relevant index data of 21 cities in the Huai river economic belt from 2010 to 2016 using dea-solver PRO5 software. The specific data are shown in table 2.

Table 2 energy conservation and emission reduction efficiency of cities in Huai river economic belt from 2010 to 2016

city	2010	2011	2012	2013	2014	2015	2016	The mean	ranking
Bengbu	1.00	0.87	0.76	1.00	1.03	1.10	1.14	0.99	13
Huainan	0.46	0.45	0.44	0.44	0.48	0.51	0.46	0.46	21
Huaibei	0.59	1.01	0.56	0.55	1.00	0.61	1.01	0.76	16
Chuzhou	1.03	1.00	1.01	1.04	1.04	1.03	1.02	1.02	10
Fuyang	1.13	1.07	1.03	1.02	1.05	1.01	0.70	1.00	12
Suzhou	0.79	0.51	0.55	0.62	0.68	0.52	0.57	0.60	19
Luan	0.77	1.03	1.03	1.02	1.04	0.61	1.08	0.94	14
Bozhou	1.35	1.30	1.35	1.28	1.20	1.15	1.18	1.26	2
Average in Anhui	0.89	0.91	0.84	0.87	0.94	0.82	0.89	0.88	（3）
Xuzhou	1.13	1.10	0.70	1.02	1.08	1.07	1.09	1.03	9
Lianyungang	1.31	1.10	1.01	1.14	1.14	1.12	1.13	1.14	4
Huaian	0.73	0.81	0.74	0.85	0.89	1.00	1.00	0.86	15
Yancheng	1.20	1.18	1.09	1.09	1.12	1.06	1.05	1.11	8
Yangzhou	1.26	1.28	1.14	1.04	1.14	1.03	1.05	1.13	5
Taizhou	1.19	1.17	1.38	1.45	1.58	1.66	1.61	1.44	1
Suqian	1.12	1.07	1.00	1.00	1.03	1.02	0.86	1.01	11
Average in Jiangsu	1.13	1.10	1.01	1.08	1.14	1.14	1.11	1.10	（1）
Pingdingshan	0.59	0.54	0.45	0.46	0.52	0.52	0.64	0.53	20
Luohe	0.76	1.07	0.81	1.06	1.28	1.50	1.89	1.20	3
Shanqiu	0.71	0.66	0.55	0.58	0.74	0.64	0.65	0.65	18
Xinyang	0.61	1.10	1.19	1.16	1.16	1.10	1.55	1.12	6
Zhoukou	1.34	1.02	1.03	1.07	1.16	1.02	1.15	1.11	7
Zhumadian	0.72	0.69	0.67	0.69	0.73	0.69	0.76	0.71	17
Average in Henan	0.79	0.85	0.78	0.84	0.93	0.91	1.11	0.89	（2）
Regional mean	0.94	0.95	0.88	0.93	1.00	0.95	1.03	0.96	

From the time series data analysis, observation in table 2, average efficiency of Huaihe river economic belt of energy conservation and emissions reduction in 21 cities from 2010 to 2016 were 0.94, 0.95, 0.88, 0.93, 1.00, 0.95, 1.03, whole showing a rising trend, that improve efficiency, energy saving and emission reduction, up from 0.94 in 2010 to 1.03 in 2016, overall rose by 9.6%, which has the highest efficiency value of 1.03, 2016, 2012, the efficiency of the lowest value is 0.88, energy conservation and emission reduction in various areas of work for further progress,Urban energy conservation and emission reduction improved. However, in the evaluation period of 7 years, only in 2014 and 2016, the average efficiency of the evaluation is no less than 1, which is effective in energy conservation and emission reduction. The year with the lowest efficiency value was 2012, which was only 0.88. It may be due to the promulgation of China's 12th five-year plan in 2011, the higher target of energy conservation and emission reduction and the strict requirements of environmental protection policies.

From the cross section data analysis, observe the figure 1201 and 2016 21 cities overall average energy saving and emission reduction efficiency value is 0.96, with an average of 14 cities efficiency value is higher than that of the overall efficiency value, there are 13 cities average efficiency value is not less than 1, energy conservation and emissions reduction efficiency is the highest average annual taizhou, is 1.44, the lowest average annual is Huainan, 0.46. It can be seen that the average efficiency value of 14 of the 21 cities in the Huai river economic belt is effective, indicating that the energy conservation and emission reduction work of these cities is effective and has made some progress during this period.

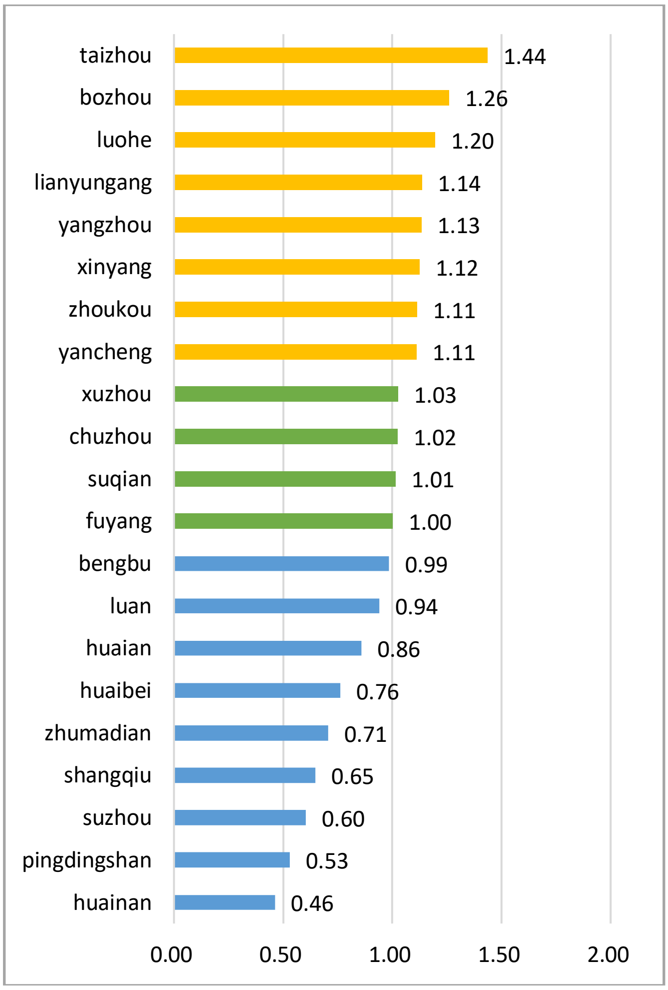

Figure 1 annual energy conservation and emission reduction efficiency of each city from 2010 to 2016

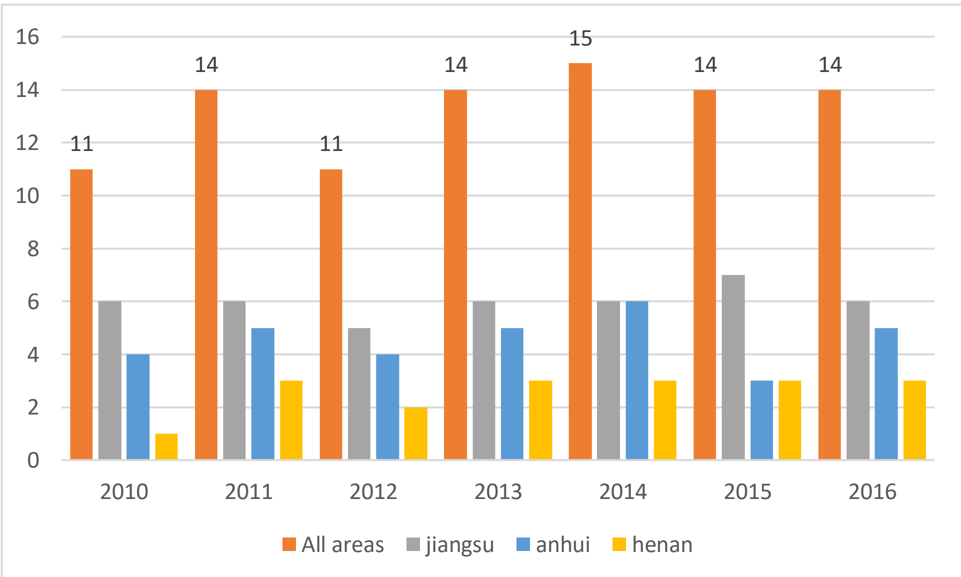

Figure 2 changes in the number of effective units of energy conservation and emission reduction efficiency from 2010 to 2016

As can be seen from figure 2, the change of the number of effective units of energy conservation and emission reduction efficiency from 2010 to 2016 can be seen. The total number of cities with energy conservation and emission reduction efficiency at the forefront of production in the Huaihe river economic belt from 2010 to 2016 fluctuated between 11 and 15. Effective unit in 2010 and 2012, the city for 11, effective unit city for 15, 2014, 4 years effective unit of the rest of the town are 14, compared to 2016 in 2010, effective unit city increase in the number three, including energy conservation and emissions reduction efficiency effective cities in jiangsu for 6, does not increase, energy conservation and emissions reduction efficiency effective cities in anhui for five (5), 1 more than in 2010, energy conservation and emissions reduction efficiency effective cities in henan for three, two more than in 2010. From the perspective of the number of effective cities in terms of energy conservation and emission reduction efficiency, the level of energy conservation and emission reduction in the Huai river economic belt has been improved, mainly due to the progress of energy conservation and emission reduction in henan and anhui regions.

5.2 Analysis of Malmquist index results for energy conservation and emission reduction

Based on the collected indicators of the Huaihe river economic belt from 2010 to 2016, the seven-year Malmquist index and its decomposition of 21 cities were calculated using DEAP 2.1 software. The results are shown in table 3 and table 4.

Table 3 Malmquist index of energy conservation and emission reduction efficiency of Huai river economic belt from 2010 to 2016 and its decomposition (by year)

year	EFFCH	TECH	PECH	SECH	Malmquist
2010-2011	1.002	0.960	0.990	1.012	0.963
2011-2012	0.984	1.069	0.982	1.002	1.051
2012-2013	1.007	0.918	0.992	1.016	0.924
2013-2014	1.029	0.999	1.035	0.995	1.028
2014-2015	0.988	1.025	1.003	0.985	1.014
2015-2016	1.018	1.304	1.006	1.012	1.328
mean	1.005	1.039	1.001	1.003	1.044

Table 3 shows that the energy conservation and emission reduction efficiency of the Huaihe river economic belt improved by 4.4% in the seven years from 2010 to 2016 based on the decomposition of Malmquist index, indicating that the overall energy conservation and emission reduction of the Huaihe river economic belt improved during this period. Further analysis of the decomposition of the index shows that the comprehensive technical efficiency and technological progress have improved by 0.5% and 3.9% respectively. The main reason for the improvement is that the technical progress index has increased by 3.9% obviously, and the comprehensive technical efficiency has also improved by 0.5% slightly.

The variation of Malmquist index from 2010 to 2016 showed a certain fluctuation. The Malmquist index decreased slightly in 2012-2013 and 2014-2015, but the reasons for the decrease were different.The decline of the Malmquist index in 2012-2013 was due to the large decline of the technical progress index, but a slight increase in the comprehensive technical efficiency index.The decline of the Malmquist index in 2014-2015 was due to the large decline of the comprehensive technical efficiency index, but a slight increase in the technical progress index.

A review of the data changes in these seven time periods shows that the variation trend of Malmquist index is the same as the variation trend of technological progress index. It can be seen that the technological progress during this period is the main reason for the improvement of energy conservation and emission reduction efficiency.At the same time, overall from 2010 to 2016, although the comprehensive technical efficiency index is greater than 1, it is only 1.005, indicating that there is still a large room for progress in the comprehensive technical efficiency, indicating that the policy formulation and institutional management of the energy conservation and emission reduction system in the Huaihe river economic belt also need to be further improved.The comprehensive technical efficiency reflects the distance between the inefficient dmu and the production front, and represents the level of dmu management and the correctness of decision making. The technological progress reflects the movement of the production frontier and represents the technological progress of the whole industry.

Table 4 Malmquist index of energy conservation and emission reduction efficiency of Huai river economic belt from 2010 to 2016 and its decomposition (by city)

city	EFFCH	TECH	PECH	SECH	Malmquist
Bengbu	1.000	1.121	1.000	1.000	1.121
Huainan	1.002	0.927	1.010	0.992	0.929
Huaibei	1.017	0.939	1.011	1.006	0.955
Chuzhou	1.000	1.025	1.000	1.000	1.025
Fuyang	0.983	0.956	0.985	0.998	0.940
Suzhou	0.979	0.962	0.979	1.000	0.943
Luan	1.021	1.140	1.001	1.020	1.164
Bozhou	1.000	0.971	1.000	1.000	0.971
Xuzhou	1.000	1.028	1.000	1.000	1.028
Lianyungang	1.000	0.972	1.000	1.000	0.972
Huaian	1.040	1.011	1.040	1.001	1.051
Yancheng	1.000	1.044	1.000	1.000	1.044
Yangzhou	1.000	1.063	1.000	1.000	1.063
Taizhou	1.000	1.113	1.000	1.000	1.113
Suqian	0.998	1.085	0.999	0.999	1.083
Pingdingshan	0.994	0.976	0.996	0.998	0.971
Luohe	1.003	1.214	1.000	1.003	1.218
Shangqiu	1.004	0.997	0.997	1.007	1.000
Xinyang	1.056	1.210	1.000	1.056	1.277
Zhoukou	1.000	1.111	1.000	1.000	1.111
Zhumadian	1.002	1.019	1.007	0.995	1.021
mean	1.000	1.121	1.000	1.000	1.121

Table 4 shows that from 2010 to 2016, the average annual energy conservation and emission reduction efficiency of cities in the Huai river economic belt improved by 12.1% on the basis of Malmquist index decomposition, indicating that the energy conservation and emission reduction of cities improved during this period.Further analysis of the decomposition of the index shows that the comprehensive technical efficiency index and the technical progress index are 1.000 and 1.121 respectively, and the main reason for the progress lies in the obvious increase of the technical progress index of 12.1%. It is basically consistent with the average energy conservation and emission reduction efficiency shown in table 3 above, which further indicates that the overall average energy conservation and emission reduction efficiency of each city has made some progress, mainly depending on technological progress. However, the management of energy conservation and emission reduction still needs to be adjusted more effectively.

From 2010 to 2016, there are 14 cities average efficiency of not less than 1, energy saving and emission reduction of chuzhou, bengbu, luan, xuzhou, Huaian, yancheng, yangzhou, taizhou, zhoukou, luohe, xinyang, zhumadian and effective energy saving and emission reduction of 12 cities, such as the main reason is that the five cities of technological progress index is high, energy saving and emission reduction and comprehensive technical efficiency index is no less than 1, explain the urban energy conservation and emissions reduction technology progress management system efficiency is also good at the same time; Suqian has an effective energy conservation and emission reduction efficiency of 1.083, of which the technical progress index is 1.085, and the comprehensive technical efficiency index is 0.998, less than 1, indicating that the management system of energy conservation and emission reduction is in urgent need of improvement. Shangqiu has an effective energy conservation and emission reduction efficiency of 1.000, of which the comprehensive technical efficiency index is 1.004, and the technical progress index is 0.997, less than 1, indicating that the technical progress in energy conservation and emission reduction is insufficient. The rest of the seven cities average efficiency of energy saving and emission reduction is less than 1, Huainan and Huaibei, fuyang respectively, suzhou, bozhou, lianyungang and pingdingshan, that during that time, work efficiency, energy saving and emission reduction or for energy conservation and emissions reduction technology is not high, or because of the low efficiency of energy conservation and emissions reduction work management or both, there are also shows the energy conservation and emissions reduction potential of the big city, there are a lot of progress in space.

6. Conclusion and suggestions

In this paper, an evaluation system for energy conservation and emission reduction efficiency of cities in Huaihe river economic belt was established, and the efficiency of cities in Huaihe river economic belt was evaluated and analyzed by using super-efficiency SBM model and Malmquist index.

6.1 Evaluation conclusion of energy conservation and emission reduction

According to the results of super efficiency SBM model analysis, it can be seen that the Huaihe river economic belt in 2010-2016 for energy conservation and emissions reduction efficiency is greater than 1, are effective, the overall effect is better, and seven years although there are fluctuations efficiency value, but the general trend of energy conservation and emissions reduction efficiency is constantly rising, this fully shows that the Huaihe river economic belt related areas in energy conservation and emissions reduction efforts are effective. In terms of years, only 2014 and 2016 are effective in energy conservation and emission reduction, while the remaining five years are inefficient. From the perspective of cities, three of the eight cities in anhui are effective in energy conservation and emission reduction, six of the seven cities in jiangsu are effective in energy conservation and emission reduction, and six of the cities in henan are effective in energy conservation and emission reduction. It shows that the efficiency of energy conservation and emission reduction in jiangsu region is relatively good, while that in anhui region and henan region is relatively low. There is still a big difference between cities, so it is necessary to further improve the level of energy conservation and emission reduction.

According to the Malmquist index and its decomposition, from 2010 to 2016, the total factor energy saving and emission reduction efficiency of the Huai river economic belt increased and improved in the process of fluctuation, mainly due to the significant improvement of the technological progress index and a slight increase in the comprehensive technical efficiency.It shows that during this period, the Huai river economic belt is making progress in energy conservation and emission reduction, and mainly depends on technological progress. However, according to the situation of 21 cities studied, 14 of them have made progress in total factor energy saving and emission reduction efficiency.In another seven cities, total factor energy conservation and emission reduction are inefficient and need to be improved.It shows that the Huai river economic belt still has a large space for progress in energy conservation and emission reduction, whether it is the improvement of technical level, or the improvement of energy conservation and emission reduction policies, systems and other management factors.

6.2 Suggestions

Strengthen scientific and technological innovation, increase investment in scientific research, strengthen technical cooperation with universities and research institutes, and further play the key role of technological progress in energy conservation and emission reduction.We will build an innovation system for green technologies that conserve energy and reduce emissions, improve the recycling of waste water, waste gas, and other waste materials, and develop and utilize clean energy, so as to minimize emissions from unintended outputs to the greatest extent possible.

Accelerate industrial adjustment, optimize industrial structure, gradually transform from high energy consumption and high pollution industry to low energy consumption and low pollution industry, improve energy utilization efficiency, optimize energy consumption structure, and attach importance to the development of environmental protection industry.

Give play to the decisive role of the market in resource allocation, strengthen the government's awareness of energy conservation and emission reduction, increase government financial input in energy conservation and emission reduction, speed up the construction of the carbon emission trading market, strive to improve the collection of environmental taxes on enterprises with high pollution and high consumption, and establish and improve the development system of low-carbon green cycle in the Huaihe river economic belt.

Strengthen the driving role of the central city of Huai river economic belt, realize the coordinated development among regions, and regions with low efficiency in energy conservation and emission reduction should learn from regions with high efficiency, promote regional energy conservation and emission reduction according to local conditions, and improve the overall energy conservation and emission reduction efficiency of the region.

Acknowledgements

Anhui Province Philosophy and Social Science Planning Major Project "Anhui Practice Research of Xi Jinping Thought on Ecological Civilization" (AHSKZD2018D04).

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