ISSN: 2710-0723

Study on the Decoupling Effect of Energy and Carbon Emissions in the Yangtze River Economic Belt under the Dual Carbon Target

Weijie Zhang*, Yuxin Xie, Yuanpeng Zhang, and Jiawei Ai

Anhui University of Finance and Economics, Bengbu 233030, China

Abstract

To achieve the goal of "double carbon" is the only way for our country to achieve emission reduction strategy. The Yangtze River Economic Belt is one of the strategic support belts for emission reduction, so it is of great significance to study the decoupling effect of energy and carbon emissions. Based on the carbon emission data of the Yangtze River Economic Belt from 1995 to 2021, this paper firstly analyzes the basic characteristics and spatial pattern of carbon emission in the Yangtze River Economic Belt. Secondly, a spatial econometric model is constructed to decompose the main influencing factors of carbon emissions in the Yangtze River Economic Belt, and the main influencing factors of economic and energy decoupling in the Yangtze River Economic Belt are explored by using the canonical correlation analysis method. Finally, BP neural network is used to forecast and analyze the carbon emission of the Yangtze River Economic Belt from 2022 to 2030. The results show that: (1) The center of gravity of carbon emissions in the Yangtze River Economic Belt is gradually shifting to the southeast, and there is a spatial correlation between regional carbon emissions. (2) The strong influencing factors of carbon emission in the Yangtze River Economic Belt are industrial composition and development differences; The influencing factors are city size and resource consumption intensity. The weak factor is the level of energy #consumption. The level of energy consumption and industrial composition are the main influencing factors of economic and energy decoupling in the Yangtze River Economic Belt. (3) Carbon emissions in the Yangtze River Economic Belt will continue to grow from 2022 to 2030, and will grow fastest from 2029 to 2030.

Keywords

Carbon Emissions in the Yangtze River Economic Belt; Spatial Econometric Model; Canonical Correlation Analysis; BP Neural Network; Emission Reduction Strategy.

1. Introduction

Carbon energy is one of the important energy sources for economic development and social progress. At the 75th session of the United Nations General Assembly, the Chinese government pointed out that China will achieve carbon peak around 2030 and carbon neutrality around 2060 [1]. In order to achieve the double carbon goal, it is necessary to adhere to the strategy of energy conservation and emission reduction, and optimize and adjust the energy structure. At the same time, it is necessary to actively promote the "dual carbon" policy in the national provinces and optimize the energy consumption structure, so as to realize the decoupling of carbon emissions and economic development.

The massive increase in carbon emissions has exacerbated global warming and energy shortages. China is the world's largest carbon emitter, with 28.4 million tons of carbon emissions since industrialization in 1850. China's economy is mainly an extensive resource-consuming economy [2]. There is a huge contrast between the urgency of energy transformation and the economy, and it is difficult to decouple, so it is in urgent need of transformation. At present, China's economic development is facing the dual pressure of slowing down growth rate and green transformation, and the "dual carbon" goal has become the main task in the new development stage [3]. During the "dual carbon" goal period, China has taken the Yangtze River Economic Belt as one of the three strategic support belts for national emission reduction. Most of the provinces and cities in the Yangtze River Economic Belt are cities with high economic development in China, where many industrial enterprises with high pollution and high emission are gathered. The heavy industrial structure means a large consumption of carbon resources and electricity. As a positive and negative pole of national development, the Yangtze River Economic Belt has been plagued with problems such as unbalanced development, large energy consumption, and large differences in urban development. In this regard, the reduction of emissions in the Yangtze River Economic Belt will play an exemplary role in achieving the two-carbon goal.

Many scholars have studied the decoupling of emission reduction and energy in the Yangtze River Economic Belt. Wu Yifan et al. [4] analyzed the relationship between carbon emission and development in the Yangtze River Economic Belt by using the CASA model and Tapio theory, and pointed out that from 2013 to 2018, carbon emission in the Yangtze River Economic Belt was in a period of fluctuation, and the downstream industries with high energy consumption were transferred. Li Genzhong and Zhu Hongliang [5] established a three-stage SBM-DEA model with non-longitude direction and non-angle, and pointed out that although the average carbon emission efficiency of provinces and cities in the Yangtze River Economic Belt showed an upward trend, the overall efficiency value was low. Guo Qingbin, Luo Kang, Yang Wanrong [6] pointed out by using the contribution rate of technological progress that due to technological progress, the carbon saving and carbon rebound in the Yangtze River Economic Belt have a gradually rising trend, and the overall carbon emission has a partial rebound effect. Zhang Tianjiao, Xu Jiangchuan, Wen Luge [7] established a multi-regional output model to analyze agriculture, manufacturing, hydropower and gas, transportation, and other service industries in the Yangtze River Economic Belt, and concluded that the inflow and outflow of hidden carbon emissions of provinces and cities in the Yangtze River Economic Belt were mainly concentrated in the eastern coastal areas. Li Qing [8] established a multi-scale spatial geographical weighted regression model to analyze the influencing factors of carbon emissions in the Yangtze River Economic Belt, and believed that cities in the Yangtze River basin should give full play to the advantages of location, talent and technology in the eastern region, concentrate industries with rigid emissions, and achieve the overall CO2 emission reduction in the basin. Tian Rongzhi et al. [9] analyzed the public's innovation and entrepreneurship ability, which is an influential factor of carbon emission in the Yangtze River Economic Belt, and tested the spatial quality of local marketization. They believed that innovation factors could reduce carbon emission intensity in neighboring regions, and the agglomeration of entrepreneurial factors would increase carbon emission in neighboring cities. Zhao Feifei et al. [10] combined the Tapio decoupling model with the Logit model to analyze the decoupling trap between carbon emissions and economic growth in the Yangtze River Economic Belt and concluded that the overall decoupling state of the Yangtze River Economic Belt is good, but there are certain spatial and temporal fluctuations. It is an important measure to improve technological innovation ability and increase foreign investment to avoid cities falling into the decoupling trap. Li Zijie et al. [11] constructed a geographically weighted model to explore the temporal and spatial heterogeneity of influencing factors of carbon emissions in cities with different locations, and believed that the Yangtze River Economic Belt should realize the planning land use and population pattern of industrial low-carbon transformation so as to achieve emission reduction. Guo Yi et al. [12] combined the IPCC inventory compilation method, network method and LMDI method to explore the influencing factors of power production and carbon emission in the Yangtze River Economic Belt, and came to the conclusion that the carbon emission of power production in the Yangtze River Economic

Belt was on the rise but the growth rate was on the decline. Zhang Chenlu and Zhang Fan [13] used relevant data of carbon emissions in the Yangtze River Economic Belt to establish a spatial Dubin model to study the impact of industrial structure and ecological protection on carbon emissions in the Yangtze River Economic Belt, and came to the conclusion that the Yangtze River Economic Belt should adhere to environmental protection and accelerate industrial transformation.

To sum up, most of the current scholars have done little research on the correlation analysis and decomposition effect of the influencing factors of carbon emission in the Yangtze River Economic Belt. Meanwhile, most scholars have neglected the research on the development trend of carbon emission in the Yangtze River Economic Belt and have not done thorough research on the influencing factors of carbon emission and the decoupling effect of energy and carbon emission in the Yangtze River Economic Belt. In this regard, this paper will analyze the basic characteristics and spatial pattern characteristics of carbon emissions in the Yangtze River Economic Belt, decompose the influencing factors of carbon emissions in the Yangtze River Economic Belt by using the spatial econometric model, and conduct typical correlation analysis on the influencing factors of the decoupling of energy and economy in the Yangtze River Economic Belt, so as to establish the evaluation system of carbon emissions and energy decoupling in the Yangtze River Economic Belt. Based on the above selected indicators, BP neural network is used to forecast and analyze the carbon emissions of the Yangtze River Economic Belt from 2022 to 2030, and valuable suggestions are put forward for the national emission reduction cause.

2. Basic Characteristics of Carbon Emission in Yangtze River Economic Belt

In this paper, the carbon emission data of 11 provinces and cities in the Yangtze River Economic Belt from 1995 to 2021 are analyzed to analyze the basic characteristics of carbon emission in the Yangtze River Economic Belt, and it is found that the carbon emission in the Yangtze River Economic Belt mainly presents the following two characteristics:

Feature 1: From the perspective of carbon emission location, the carbon emission of the Yangtze River Economic Belt is generally distributed in a low and high pattern, and the carbon emission of coastal cities is significantly more than that of non-coastal cities.

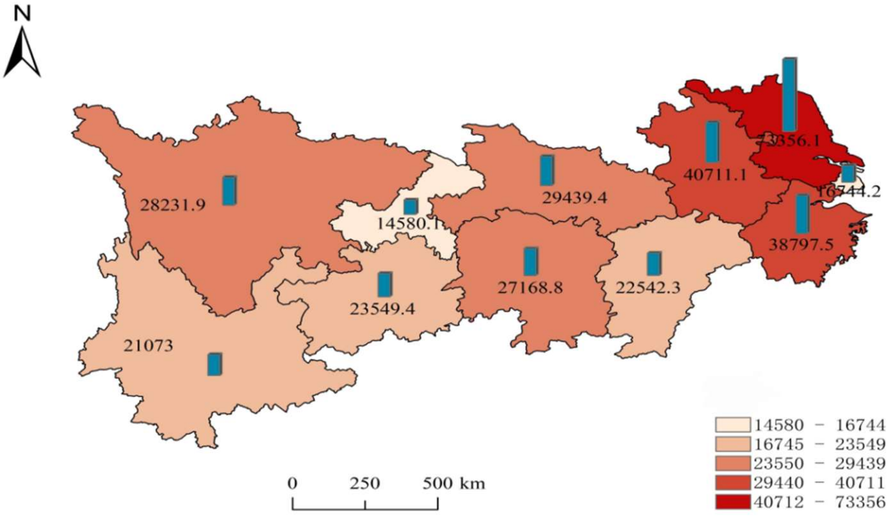

Figure 1. Carbon emission location map of the Yangtze River Economic Belt in 2021

In order to analyze the current carbon emission situation of the Yangtze River Economic Belt, this paper draws the carbon emission location map of the Yangtze River Economic Belt in 2021 based on the collected data. On the whole, the carbon emission in the Yangtze River Economic Belt shows a distribution pattern of "low and high". As can be seen from the figure, Jiangsu Province has the highest carbon emission content, 733.5661 million tons, while Chongqing has the lowest carbon emission content, 145.801 million tons. Among them, the top three cities with carbon emissions are located in the lower reaches of the Long Economic Belt, while in the upper reaches, except for Sichuan Province, the carbon emissions of other upstream cities of the Yangtze River Economic Belt are more than 24 million tons. From the perspective of geographical location, the lower reaches of the Yangtze River Economic Belt are coastal areas with relatively rich resources. Therefore, the downstream cities vigorously develop energy-consuming industries, resulting in high carbon emissions. In the middle and upper reaches of the Yangtze River Economic Belt, due to geographical environment and other factors, the development speed of heavy industry and other industries with high energy consumption is lower than that of the lower reaches, so the carbon emission is less.

Feature 2:From the perspective of carbon emission transfer, the overall carbon emission in the Yangtze River Economic Belt shows a distribution pattern of "high in the east and low in the west". Meanwhile, with the further promotion of economic and industrial development, the center of gravity of carbon emission gradually shifts to the southeast.

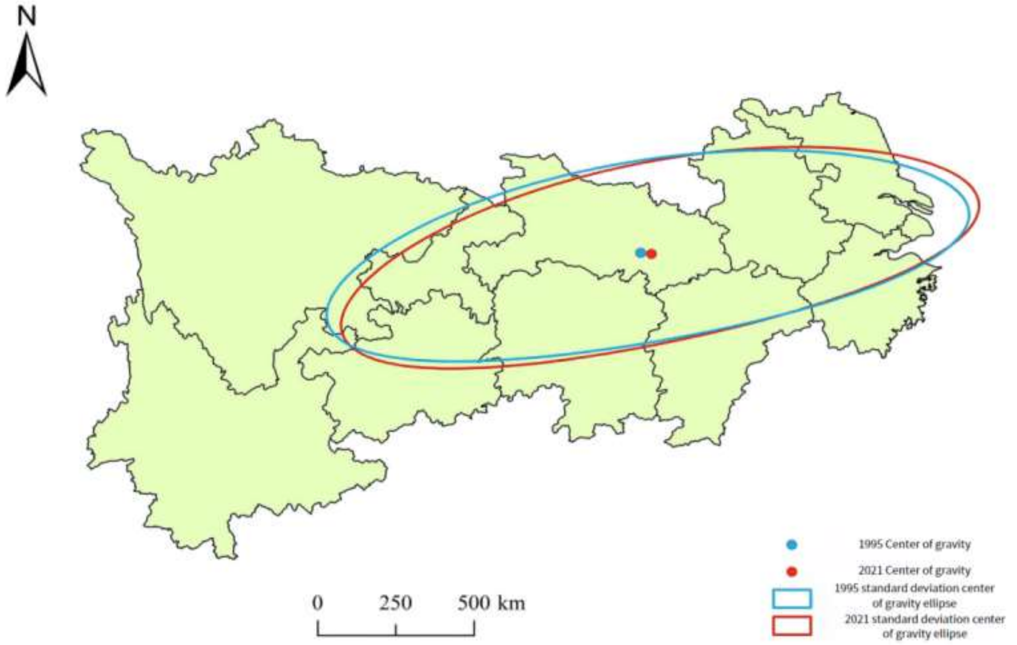

Figure 2. Center of gravity - standard deviation ellipse of carbon emissions in the Yangtze River Economic Belt in 1995 and 2021

In order to explore the changes of carbon emissions in the Yangtze River Economic Belt, this paper draws the center of gravity standard deviation ellipses of the Yangtze River Economic Belt in 1995 and 2021. As can be seen from the figure, the center of gravity of the ellipse moves to the southwest, indicating that the center of gravity of carbon emissions in the Yangtze River Economic Belt has gradually shifted to the southeast since 1995, and the level of carbon emissions in the southeastern region has gradually increased. At the same time, from the perspective of ellipse area, the standard deviation ellipse of 2021 is smaller than the standard deviation ellipse area of 1995. It shows that the carbon emission in the Yangtze River Economic belt is gradually concentrated. Moreover, from the drawn images, it can be seen that the two ovals are mainly located in the middle and lower reaches of the Yangtze River Economic Belt, indicating that the middle and lower reaches of the Yangtze River Economic Belt are the main sources of carbon emissions in the Yangtze River Economic Belt, showing a spatial distribution pattern of carbon emissions "high in the east and low in the west". From the perspective of data, it can also be proved that Zhejiang Province and Jiangsu Province in the lower reaches of the Yangtze River Economic Belt are the top two carbon emission among the 11 provinces and cities in the Yangtze River Economic Belt, while Chongqing City has the lowest carbon emission. From the above analysis, it can be seen that the carbon emissions in the Yangtze River Economic Belt mainly show a distribution pattern of "high in the east and low in the west", and the distribution center of carbon emissions gradually shifts to the southeast.

3. Spatial Pattern of Carbon Emissions in the Yangtze River Economic Belt

In order to analyze the spatial pattern of carbon emissions in the Yangtze River Economic Belt, this paper selected Moran's I index as the evaluation index of the spatial correlation of the Yangtze River Economic Belt.

The spatial weight matrix was constructed to calculate the global Moran's I coefficient of urban carbon emissions in the Yangtze River Economic Belt from 1995 to 2021. The specific results are shown in Table 1, Table 2 and Table 3:

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Table 1. Global Moran's I index from 1995 to 2003

year	1995	1996	1997	1998	1999	2000	2001	2002	2003
Moran’s I exponent	-0.102	-0.111	-0.051	-0.018	0.074	0.154	0.154	0.179	0.026
P value	0.496	0.475	0.391	0.32	0.162	0.075	0.035	0.057	0.107

Table 2. Global Moran's I Index from 2004 to 2012

year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Moran’s I exponent	0.094	0.048	0.07	0.058	0.078	0.002	-0.043	-0.014	-0.035
P value	0.136	0.201	0.168	0.185	0.157	0.282	0.373	0.313	0.356

Table 3. Global Moran's I index from 2013 to 2021

year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Moran’s I exponent	-0.01	-0.012	0.000	0.013	0.012	0.066	0.051	0.058	0.08
P value	0.267	0.309	0.286	0.262	0.262	0.173	0.196	0.185	0.153

Taking P=0.1 as the test criterion, it can be seen from the table that under the significance test level of 10%, the tests passed in 2000, 2001 and 2002, and the corresponding global Moran's I values were all greater than 0, thus showing the global autocorrelation. Other years that failed the test showed no global autocorrelation.

In order to further analyze the spatial correlation between cities, local Moran's I index is introduced to analyze the spatial correlation.

Analysis in 2021: The eastern region is relatively rich in resources, has rapid economic development, has a number of high-energy enterprises, and the speed of carbon dioxide diffusion in coastal areas is faster. In the two observation years, Shanghai is located in the second quadrant, and Jiangsu, Zhejiang and Anhui are always located in the first quadrant. Carbon emissions in the four regions are at a high level and highly concentrated. Hunan, Sichuan and Guizhou are the middle and upper reaches of the Yangtze River Economic Belt, located in the west of the belt. The development time of the western region is generally later than that of the eastern region. At the same time, the western region has higher terrain, more mountains and basins, and a large development gap between the development of industries and high-energy-consuming industries and the eastern cities. Thus, the Moran scatter plot shows that the origin point is relatively close, and the development of carbon emissions of cities in this region is restrained under the common factors of geographical environment and economic development.

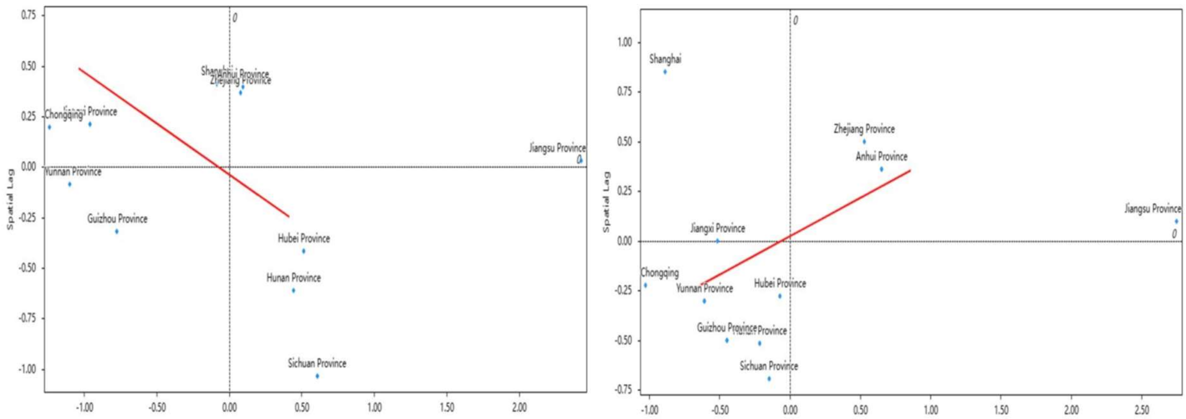

Figure 3. Local Moran Scatter plot in 1995 (left) and 2021 (right)

4. Decomposition of Influencing Factors of Carbon Emissions in the Yangtze River Economic Belt and Analysis of Economic and Energy Decoupling Factors

4.1. Decomposition of Influencing Factors of Carbon Emissions in the Yangtze River Economic Belt

1) Spatial econometric model

Spatial econometric models can effectively analyze the complex spatial correlation and dependence of research objects, and can be divided into spatial lag model, spatial error model and spatial Durbin model according to different spatial correlation influence characteristics.

①Spatial lag model

The spatial lag model is similar to the autoregressive model in that it is affected by both its own explanatory variables and other spatial explanatory variables. The expression is shown in (1).

$$y = \alpha W_y + X\beta + \varphi \tag{1}$$

②Spatial error model

The spatial error model introduces the regression term into the error so as to study the autocorrelation of the error term. The expression is shown in (2).

$$y = X\beta + WX\phi + \eta, \eta = \gamma W_\eta + \varphi \tag{2}$$

③Spatial Durbin model

The spatial Durbin model is an extended form of spatial lag model and spatial error model, taking into account the autocorrelation of dependent variables and independent variables. See (3) for the expression.

$$y = \theta W_1 Y + X\beta + W_2 X\phi + \varphi \tag{3}$$

2) Selection of data and model metrics

Due to the lack of some data, the spatial econometric model of this paper selects the data of 11 provinces and cities in the Yangtze River Economic Belt from 2000 to 2021 to construct, and the relevant indicators calculated are shown in Table 4.

Table 4. Correlation variables of spatial measurement model

variable	Text symbol	Data index
Industrial composition	IC	The proportion of the added value of the secondary industry in the gross regional product of the Yangtze River Economic Belt
City size	CS	Population density of cities in the Yangtze River Economic Belt
Intensity of resource consumption	IR	Total energy consumption of cities in the Yangtze River Economic Belt
Energy consumption level	EL	The ratio of total energy consumption of cities in the Yangtze River Economic Belt to the level of city size
Development difference	DE	Gini coefficient of cities in Yangtze River Economic Belt

3) Modeling result analysis

Table 5. Results of model regression

variable	Time-fixed effect	Individual fixation effect	Double fixed effect
IC	24698.31***	20708.68***	6420.354
CS	-1.455922*	-6.562843***	-6.413001***
IR	2.979184***	1.933395***	2.209871***
EL	-0.8232218***	-0.3763053***	-0.6034165***
DE	56393.77***	79224.1***	69872.1***

Note: *, ** and *** are significant for P≤0.1, P≤0.05 and P≤0.01, respectively.

Based on the results in Table 5, in order to explore the main influencing factors of carbon emissions in the Yangtze River Economic Belt, five possible influencing factors were analyzed in combination with their time fixed effects, individual fixed effects and double fixed effects:

Industrial composition: In addition to the double fixed effect that fails to pass the test, both the time fixed and the individual single fixed cases pass the significance test of 1%, and the effect is positive, that is, with the expansion of industrial composition, the carbon emission of the Yangtze River Economic Belt will further increase. Moreover, its effect size is large, and this paper holds that the industrial composition is a strong influencing factor of carbon emission in the Yangtze River Economic Belt.

City size: its time-fixed effect passes the significance test of 10%, and the other two effects pass the significance test of 1%, both of which have a negative effect on the carbon emissions of the Yangtze River Economic Belt, but the effect is small. This paper believes that the city size is the influencing factor of the Yangtze River Economic Belt.

Resource consumption intensity: All three effects passed the significance test of 1% and showed positive effects, but the effect value was small and the impact on carbon emissions in the Yangtze River Economic Belt was small. This paper believes that resource consumption intensity is a central factor affecting carbon emissions in the Yangtze River Economic Belt.

Energy consumption level: It can be seen from Table 5 that the three effects, all of which pass the significance level of 1%, have a negative effect on the carbon emission of the Yangtze River Economic Belt, but the effect value is too small. This paper believes that the influence of this influencing factor on the carbon emission of the Yangtze River Economic belt is small and weak.

Development difference: The three effects all passed the significance test of 1%, showing positive effects with large effect values, which is considered as a strong influencing factor for carbon emissions in the Yangtze River Economic Belt in this paper.

Based on the above analysis, this paper concludes that the influencing factors of carbon emissions in the Yangtze River Economic Belt are as follows:

(1) Strong influencing factors: industrial composition and development differences;

(2) Influencing factors: city size, resource consumption intensity;

(3) Weak influencing factor: energy consumption level.

4.2. Analysis of Decoupling Factors Between Economy and Energy in the Yangtze River Economic Belt

1) Indicator selection and model description

In order to study the decoupling effect of economy and energy, this paper sets the gross regional product and carbon emissions of the Yangtze River Economic Belt as comprehensive dependent variables, and conducts a typical correlation analysis on the possible independent variables affecting city size, economic development difference, energy consumption level and industrial structure, so as to find the main influencing factors of the economic decoupling of the Yangtze River Economic Belt.

Canonical correlation analysis is an analysis method that reflects the overall correlation between two groups of indicators by using the correlation between synthetic variable pairs. Its basic principle is: divide the objects to be studied into two groups, establish the expression between the two groups of indicators in general, and analyze the correlation between the indicators.

2) Modeling results and analysis

Suppose that the gross regional product and carbon emissions of the Yangtze River Economic Belt are set u, and the urban size, development difference, energy consumption level and industrial composition are set v. The calculation results of the typical correlation coefficients of the two sets are shown in Table 6.

Table 6. Typical correlation coefficients of the two groups of variables

Class number	Canonical correlation coefficient	Wilks' lambda	df1	df2	F value	P value
1	0.999	0.000	8.000	32.000	205.158	0.000**
2	0.900	0.189	3.000	17.000	24.272	0.000**

Note:* P<0.05 ** P<0.01.

It can be seen from the calculated results that the typical correlation coefficients of the two groups are significant at the significance level of 1%. In order to ensure the reliability of the analysis results, the group number 1 with a large correlation coefficient is selected in this paper for subsequent analysis.

Table 7. Typical load coefficients between set v and possible influencing variables

variable	Group of correlation coefficients 1	Group of correlation coefficients 2
City size	-0.007	0.289
Development difference	0.013	0.465
Energy consumption level	0.991	0.133
Industrial composition	0.994	-0.107

The larger the typical load coefficient, the greater the influence of the related variables on the set v. Therefore, it can be seen that energy consumption level and industrial composition are the main influencing factors of economic and energy decoupling in the Yangtze River Economic Belt, while urban size and regional development differences have little influence on it. In order to realize the economic and energy decoupling of the Yangtze River Economic Belt, the 11 provinces and cities in the Yangtze River Economic Belt should further optimize the industrial structure, reduce the use of polluting energy, and develop clean energy. Optimize the provincial and entrepreneurial structure of enterprises, encourage and publicize the use of low-energy resources, and improve energy consumption. Provinces and cities cooperate with each other to alleviate regional economic development differences, and rationally expand the city scale on the basis of reducing energy consumption to ensure the smooth progress of the decoupling of economy and energy.

5. Prediction and Analysis of the Future Development of Carbon Emissions in the Yangtze River Economic Belt

5.1. Description of BP Neural Network

BP neural network is a multi-layer feedforward neural network trained according to the error backward propagation algorithm, and its calculation is divided into two steps: forward and reverse. Forward computation: The input mode is processed layer by layer from the input layer through the hidden unit layer and towards the output layer, where the neurons in each layer only affect the neurons in the next layer. If the desired result is not obtained in the output layer, the forward calculation is changed to the reverse calculation, the error signal is returned along the original connection path, and the error signal is minimized by modifying the weight of each neuron.

5.2. Selection of Relevant Indicators

From the analysis of influencing factors of carbon emissions in the Yangtze River Economic Belt, it can be seen that the strong influencing factors of carbon emissions in the Yangtze River Economic Belt are industrial composition and development difference, the medium influencing factors are city size and resource consumption intensity, and the weak influencing factors are energy consumption level. Therefore, this paper chooses strong and medium influential factors as the input values of BP neural network, and the carbon emissions of the Yangtze River Economic Belt as the output values.

5.3. Projections of carbon emissions

Table 8. Related parameters of BP neural network

Parameter name	Parameter value
Activation function	identity
solver	lbfgs
Learning rate	0.1
L2 regular term	1
Number of iterations	1000
Hide the number of layer 1 neurons	100

Table 9. Fitting parameters of the model

model	Training set of MSE	RMSE of the training set	MAE of the training set	R^2
BP neural network	1379131716.55	19471.305	213730.606	0.936

MSE refers to mean square error; the smaller the RMSE is, the better the fitting effect of the model; the smaller the RMSE is, the higher the accuracy of the model; MAE is the average absolute error, reflecting the prediction error; the smaller the model, the more accurate it is; R2 is the goodness of fit of the model, the closer it is to 1, the better the model fits. There was no model comparison and only goodness of fit was analyzed. It can be seen from Table 11 that the goodness of fit of the model is 0.936, which is very close to 1, so the model has a good fit.

In this regard, BP neural network is used to forecast the carbon emissions of the Yangtze River Economic Belt from 2022 to 2030, and the prediction results are shown in Table 10.

Table 10. Forecast results of carbon emissions in the Yangtze River Economic Belt from 2022 to 2030

Forecast year	Carbon emission projections (10,000 tons)
2022	314287.93149376946
2023	323104.36660294083
2024	322768.7532833012
2025	332085.0331502833
2026	340075.6472627893
2027	347778.3661327611
2028	360323.2596120315
2029	367845.11307813507
2030	405159.30057027214

As can be seen from the predicted results in Table 10, the total carbon emissions of the Yangtze River Economic Belt will maintain a growing trend from 2022 to 2030, and will grow fastest from 2029 to 2030. 2030 is the target date for China to achieve the "carbon peak" strategy, in this regard, the provinces and cities in the Yangtze River economy should actively optimize the industrial structure and increase the use of clean energy, so as to mitigate the large increase in carbon emissions caused by fossil fuels such as oil and coal. We will increase investment in emission reduction and promote the transformation of polluting enterprises. Cooperation between regions should be strengthened, and faster growing cities should promote the development of backward cities, so as to promote emission reduction while ensuring efficient economic development.

6. The Optimization of Carbon Emission Mitigation and Economic and Energy Decoupling in the Yangtze River Economic Belt

Based on the above results, the following suggestions are put forward for carbon emission mitigation and economic and energy decoupling in the Yangtze River Economic Belt:

Cities in the lower reaches of the Yangtze River Economic Belt have relatively high carbon emissions, and the lower reaches are coastal areas. At the same time, the lower reaches of cities have rapid economic development, which leads to a rapid increase in carbon emissions. In this regard, downstream cities should focus on energy transformation and actively seek clean energy to replace polluting energy. At the same time, pay attention to technological breakthroughs, develop emission reduction technologies such as carbon capture and storage technology, biological carbon sequestration, etc., to promote emission reduction; The government needs to strengthen the management of high energy consumption and high pollution enterprises, encourage enterprises to reduce emissions, and promote the use of clean resources. Middle and upstream cities should also actively respond to the national emission reduction strategy, while improving production capacity, to ensure the coordinated development of economic and environmental resources.

Acknowledgments

This work was financially supported by the Research and Innovation Fund Project for undergraduates of Anhui University of Finance and Economics (project number: XSKY23235), Study on the decoupling effect of energy and carbon emissions in the Yangtze River Economic Belt under the dual carbon target.

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