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Retraction

Retracted: Spatial Heterogeneity Analysis of Resource Allocation Efficiency of Sports Venues in China from the Perspective of Polarization Theory

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Cao, J. Geng, and W. Shen, "Spatial Heterogeneity Analysis of Resource Allocation Efficiency of Sports Venues in China from the Perspective of Polarization Theory," *Mobile Information Systems*, vol. 2022, Article ID 6143771, 9 pages, 2022.

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Research Article

Spatial Heterogeneity Analysis of Resource Allocation Efficiency of Sports Venues in China from the Perspective of Polarization Theory

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There are not many analyses of the degree of variation in the efficiency of the allocation of sports venues in China. The results show that the allocation efficiency of sports venues in China is very high. The results show that the efficiency of the allocation of sports venues in China generally shows a fluctuating upward trend, with the average efficiency value increasing from 0.7 in 2013 to 0.9 in 2014, and there are significant differences at the three regional levels of East, Central, and West China and at the level of each province and autonomous region. The efficiency of the allocation of sports venue resources in the three regions shows a geographical pattern of "eastern region > western region > central region." The regional disparity in the efficiency of the allocation of sports venue resources in China gradually increases during the period under study, with the opening and closing values of the kernel density curve for 2013–2017, showing an overall ". The nuclear density curve in 2017 shows an obvious bimodal curve distribution. Compared with other years, it can be clearly seen that there are fewer areas with low values and more areas with high values. The polarization of the efficiency of China's sports venue resource allocation and layout has been revealed, and the core density curve is shown as a whole. It can be seen from the sports venue resource allocation index that during the study year, the changes and fluctuations of each major region were different, and the national Er index showed a trend of "Λ." The shape of the national Er index is "Λ," while the eastern, central, and western regions are in the shape of "N," declining slowly and remaining stable, respectively. The ER index fluctuates the most in the eastern region. Hence, the change in the ER index in eastern China plays a dominant role in the polarization of the overall resource allocation efficiency of sports venues in China.

1. Introduction

During the 14th Five-Year Plan period, the Central Committee of the Party and the State Council attach great importance to the development of sports in China, and it is also a critical period for building a strong sports nation. The content of a sports power should include establishing a national fitness service system, covering urban and rural areas, adhering to the reform and improvement of the national system of competitive sports, constantly expanding opening-up, deepening reform, analysis of institutional factors restricting the development of sports industry and elimination of sports institutional obstacles, and cultivating and enhancing the international influence of Chinese sports. The implementation of national regional development and the promotion of the coordinated development of sports are being deployed and promoted at the same time, and efforts are being made to solve the current problem of unbalanced development of sports resources between regions. As far as sports venue resources are concerned, achieving an increase in the level of sports venue resource allocation is an important reflection of the implementation of the 14th Five-Year Plan for Sports [1]. The management of sports science and technology resources mainly includes the management system of sports science and technology, the management of sports scientific research activities, and the management of sports scientific and technological achievements.

Resources refer to the collection of various elements, such as material, financial, and human resources, possessed within a country or a region, and they can be divided into natural resources, human resources, and processing resources for human development and use [2]. The characteristics of natural resources include the limitation of quantity, the imbalance of distribution, the connection between resources, and the development of utilization. Sports venue resources are the intersection of natural resources and social resources, and their constituent elements mainly include material and financial resources invested in venue construction and personnel and information required for venue management. The Sixth National Sports Venue Census defines sports venues as the collection of human, physical, financial, and information elements invested in the construction and management of sports facilities dedicated to sports training, competition, and fitness activities, with a certain amount of investment, public welfare, or business, including the necessary ancillary functional rooms [3]. The ways to improve the efficiency of sports resource allocation include the optimization of allocation methods and allocation policies.

Existing research on the efficiency of sports venue resource allocation is mainly focused on three aspects: firstly, the connotation, objectives, principles, and modes of sports allocation are discussed at the theoretical level, pointing out that efforts should be made to broaden funding channels and actively strengthen scientific management as the key to sports venue resource allocation [4–6]. The basic national conditions of our country determine that the supply of sports resources in our country will be in a state of short supply for a long time, i.e., the contradiction between the continuous expansion of the demand for sports resources in the development of sports and the relative shortage of national sports resources, and this contradiction will exist for a long time. Therefore, with the vigorous development of China's sports industry and the continuous improvement of sports high-tech level, it is particularly important to carry out scientific, standardized management of sports resources. The second is the policy-level thinking about how to effectively improve the level of sports resources allocation. Scholars generally believe that the level of sports venue resources allocation is the result of the interaction between government policies and market economy. The "Blueprint for Sports Facilities" in Singapore, the "Gold Plan" in Germany, the "Healthy Citizenship Program" in the United States, as well as sports lottery, corporate sponsorship, and other market-based means subsidize the construction of sports venues [7–11]. The development and management of sports venue resources mainly includes sports venue resources, the classification and function of sports venue resources, and the development and management of sports venue resources. These government policies have greatly met the demand of the public for sports activities. The third is an empirical analysis of the spatial and temporal changes in the level of sports resource allocation in cities at different scales, including the measurement methods [12–14], spatial and temporal patterns [15–17], and influence mechanisms of the level of sports venue allocation [18–22].

To avoid the limitations of single-indicator evaluation, scholars regard the process of sports venue resource allocation as a production system with multiple inputs and multiple outputs, and evaluate it by constructing a sports venue resource allocation evaluation system and adopting the data envelopment analysis method, which is a typical and representative research model for efficiency evaluation at present. Data envelopment analysis is a quantitative analysis strategy to evaluate the relative effectiveness of the comparable units of the same type using the linear programming method according to multiple input indicators and multiple output indicators. With the continuous improvement of research methods, scholars have used the DEA model combined with spatial autocorrelation, Theil index, Gini coefficient decomposition, and other methods to analyze the overall characteristics and evolution pattern of the resource allocation efficiency of different regions and different research objects in a multilevel and multiperspective manner, however, research is conducted seldom on the allocation efficiency of sports venue resources. There is a certain complementarity between the Theil entropy index and the Gini coefficient. The Gini coefficient is particularly sensitive to changes in the medium level. One of the biggest advantages of measuring inequality with Theil entropy index is that it can measure the contribution of intra group gap and inter group gap to the total gap. This paper constructs the polarization index of sports venue resource allocation efficiency, analyzes the efficiency of sports venue resource allocation from the perspective of the polarization theory, combines the DEA model and kernel density estimation method, and analyzes the spatial and temporal characteristics of the differences of sports venue resource allocation efficiency among 30 provinces and autonomous regions in mainland China from 2013 to 2017. This study provides a new research perspective and methodology for the systematic study of sports venue resource allocation efficiency. Note that on the basis of univariate kernel density estimation, the prediction model of value at risk can be established. By weighting the coefficient of variation of kernel density estimation, different prediction models of value at risk can be established.

2. Research Methodology and Data Sources

2.1. Research Ideas. The theory of unbalanced growth, proposed by French economist Perrou in the 1950s, focuses on analyzing the unbalanced problems encountered in the process of regional economic development. The difference between the two sectors comes from the different roles played by technology and labor. In the progressive sector, technology plays a decisive role. In nonprogressive sectors, labor plays a decisive role. This paper analyses the efficiency of sports venue resource allocation in China from a polarization perspective, i.e., observing the unbalanced pattern of sports venue resource allocation and the integration of various elements in China from a polarization perspective and looking for a coordinated development path. This paper, firstly, measures the efficiency of sports venue allocation in each province, city and autonomous region of China with the help of the DEA method to grasp the overall situation of sports venue resource allocation. Secondly, the kernel density method is used to analyze the time-varying characteristics of the differences in the efficiency of the allocation of sports venue resources. Finally, the polarization measurement model is used to reveal the spatial polarization

pattern of sports venue resources in China. The characteristics of sports facilities include that there are differences in the requirements for sports facilities. Sports facilities for competition must first meet the rules of sports competition. All sports facilities emphasize the thoughtful and full protection of athletes, i.e., the importance of safety, applicability, and environmental protection.

2.1.1. Super-SBM Model. The DEA method is mainly used to evaluate the relative efficiency of decision units with multiple inputs and outputs. It avoids calculating the standard cost of each service because it can convert a variety of inputs and outputs into the numerator and denominator of efficiency ratio without converting into the same monetary unit. Therefore, using DEA to measure efficiency can clearly explain the combination of input and output. The traditional DEA models, namely the CCR and BCC models, do not consider same proportion change to efficiency bias, and the traditional DEA models measure the maximum value of efficiency, i.e., the efficiency of effective decision units is 1, which cannot rank the effective decision units again. Therefore, this paper measures the efficiency of sports venue resource allocation with the help of super-SBM [23]. In this paper, based on the existing research results, social fund, lottery fund, and government financial input are selected as input indicators, and social sports instructors, the indoor area of large stadiums, and outdoor sports venue area are output indicators, which indicate the efficiency of sports venue resources and sports talents in the process of sports development, respectively. Social funds include the following: social funds are a part of funds, which the state has the right to regulate. Social funds are closely related to social reproduction, and social funds can bring new value in the movement. The efficiency values were measured according to MAX DEA 6.0 and visualized with the help of Arc GIS 10.2. The specific model of super-SBM is as given below. Note that the lottery fund refers to the fund obtained after the realization of lottery sales, which is composed of lottery public welfare fund, reward bonus, and issuance funds.

$$\begin{aligned}
\min \rho_{SE} &= \frac{1 + 1/m \sum_{i=1}^{m} S_i^- / x_{ik}}{1h - 1/S \sum_{r=1}^{s} S_r^+ / y_{rk}}, \\
&s.t. \\
&\sum_{j=1, j\neq k}^{n} x_{ij}\gamma_i - S_i^- \leq x_{ik}, \\
&\sum_{j=1, j\neq k}^{n} x_{rj}\gamma_j + S_r^+ \geq y_{rk}, \\
&\gamma, S^-, S^+ \geq 0, \\
&i = 1, 2, \ldots, q;\ j = 1, 2, \ldots, n (j \neq k),
\end{aligned} \tag{1}$$

where ρ_{SE} is the efficiency of sports venue resource allocation. x and y are input and output factors, respectively. m and s denote the number of input indicators and output indicators. k denotes the production period. i and r represent the decision-making units, DMU, of input and output, respectively. $S^+$and S^- represent the slack variables of input and output, respectively. γ is the weight vector. When $\rho_{SE} \geq 1$, the apparent decision unit is relatively efficient and in the production efficient frontier. When $\rho_{SE} \leq 1$, it indicates that the decision unit is relatively inefficient and efficiency loss occurs.

2.1.2. Kernel Density Estimation. Kernel density estimation methods study the characteristics of data distribution from the data sample itself, without taking into account the data a priori. Used to estimate an unknown density function, it is one of the nonparametric testing methods and is highly valued in both statistical theory and its application areas [24]. The methods of kernel density estimation include parametric estimation and nonparametric estimation. Parameter estimation can be divided into parametric regression analysis and parametric discriminant analysis. In parametric regression analysis, it mainly assumes that the data distribution conforms to a specific behavior and then determines the unknown parameters in the regression model. Let the given data $x_1, x_2, \ldots, x_n$ obey the same distribution. Its density function $f(x)$ is unknown. We need to estimate the density function $f(x)$ with the help of the sample. The empirical density function of the sample is known to be the following: $F(x) = 1/n\{X_1, X_2, \ldots, X_n\}$. Then, the kernel density function is estimated in the form of the following:

$$\begin{aligned}
f_n(x) &= \frac{[F_n(x + h_n) - F_n(x - h_n]}{2h} \\
&= \int_{x-h_n}^{x+h_n} \frac{1}{h} K\left(\frac{t - x}{h_n}\right) dF_n(t) \\
&= \frac{1}{nh_n} \sum_{i=1}^{n} K\left(\frac{x - x_i}{h_n}\right),
\end{aligned} \tag{2}$$

where h_n is the window width, and $K(*)$ is the kernel density function. There are more methods to estimate the kernel density function. When the function relationship cannot be judged, Gaussian kernel function is superior to other kernel functions. Hence, this paper kernel density estimation $K(*)$ uses the Gaussian kernel function, which is as follows: $Gaussian = 1/\sqrt{2\pi} e^{-t^2/2}$. The window width is $h_n = 0.9SN^{-0.8}$, where N is the sample size and S is the sample difference. Th kernel density estimation method does not use the prior knowledge of data distribution, and it does not attach any assumptions to the data distribution. It is a method to study the characteristics of data distribution from the data sample itself. Therefore, it is highly valued in the field of statistical theory and application.

2.1.3. Spatial Polarization Measure-ER Index. The Esteban-Ray (ER) index is a typical quantitative analysis method for measuring spatial polarization in theoretical circles, emphasizing the spatial clustering of samples [25]. The basic idea of this index is to compare variables with each other, so as to determine the benchmark of comparison and finally

Table 1: Efficiency values for the allocation of sports venue resources in each municipality and autonomous region, 2013–2017.

	2013	2014	2015	2016	2017
Beijing	0.824	0.913	0.913	1.094	1.299
Tianjin	0.799	1.077	1.021	1.883	1.317
Hebei	0.747	0.897	0.886	0.901	1.023
Shanxi	0.547	0.553	0.576	0.611	0.712
Inner Mongolia	0.325	0.367	0.382	0.526	0.561
Liaoning	0.655	0.674	0.701	0.725	0.780
Jilin	0.646	0.663	0.675	0.693	0.727
Heilongjiang	0.602	0.624	0.626	0.635	0.683
Shanghai	1.070	1.406	1.689	1.692	1.693
Jiangsu	1.125	1.322	1.342	1.324	1.331
Zhejiang	1.240	1.365	1.258	1.274	1.293
Anhui	0.843	0.893	0.902	0.921	0.924
Fujian	1.137	1.243	1.233	1.246	1.256
Jiangxi	0.732	0.732	0.734	0.734	0.738
Shandong	1.137	1.142	1.158	1.155	1.153
Henan	0.556	0.565	0.573	0.583	0.633
Hubei	0.775	0.777	0.774	0.775	0.779
Hunan	0.785	0.796	0.797	0.796	0.805
Guangdong	1.337	1.332	1.463	1.465	1.457
Guangxi	0.535	0.563	0.572	0.577	0.621
Hainan	1.132	1.144	1.032	1.210	1.325
Chongqing	0.979	0.997	1.191	1.179	1.175
Sichuan	0.621	0.654	0.681	0.692	0.752
Guizhou	0.436	0.462	0.525	0.536	0.561
Yunnan	0.462	0.478	0.528	0.572	0.602
Shaanxi	0.254	0.433	0.468	0.570	0.682
Gansu	0.354	0.430	0.455	0.538	0.542
Qinghai	0.300	0.365	0.363	0.468	0.473
Ningxia	0.632	0.643	0.648	0.688	0.687
Xinjiang	0.242	0.346	0.362	0.471	0.467

measure the level of differentiation between variables. Its calculation formula is as follows:

$$f_{ER} = K\sum_{i=1}^{n}\sum_{j=1}^{n} P_I^{1+\sigma} P_j \left|X_i - X_j\right| K = \frac{k}{\mu}, \mu = \sum_{i=1}^{n} P_i X_i, \quad (3)$$

where f_{ER} is the Esteban-Ray index. The larger the value, the higher the degree of spatial polarization of the surface sports venue resource allocation efficiency. $k > 0$ is a standardized parameter. In the process of polarization index measurement, the value of k is adjusted according to the specific data to ensure ERϵ(0, 1). n indicates the number of study areas, P is the weight, and P_i and P_j represent group i and group j, respectively. total samples and number of samples, X_i and X_j represent the average sports venue resource allocation efficiency of group i and group j samples, respectively. σ is the polarization sensitivity coefficient, which takes the value range of $\sigma\epsilon$(0, 1.6).

2.2. Data Sources. The research data was mainly obtained from the 2013 to 2017 China Statistical Yearbook and the Sports Business Statistical Yearbook. This study does not involve China's Hong Kong, Macao, and Taiwan regions, and it mainly focuses on the provinces, cities, and autonomous regions in mainland China, among which data related to the sports business in Tibet is missing, and as the data related to the 2018–2022 Sports Business Statistical Yearbook has not yet been published, the study examines the 30 provinces, cities, and autonomous regions in mainland China, and the period of examination is 2013 to 2017.

3. Empirical Analysis

3.1. Analysis of the Overall Efficiency of Sports Venue Resource Allocation. Table 1 shows the distribution of the spatial pattern of sports venue resources allocation in China's provinces, cities, and autonomous regions from 2013 to 2017, and Figure 1 shows a visualization of the efficiency of sports venue resource allocation in China's provinces, cities, and autonomous regions from 2013 to 2017. Figure 2 reflects the development of the average value of sports venue resource allocation efficiency between China and the three major regions of China over the period under examination.

The efficiency of sports venue resources has been slowly increasing at the national level, from 0.728 in 2013 to 0.904 in 2017, across the 30 provinces, municipalities, and autonomous regions of China, thanks to increased investment from government finance and social funds, as well as government policy support. The average value of the national sports venue resource allocation efficiency during the examination period was 0.826, which is already high as far as the national level is concerned, and although it has not reached the effective frontier surface, it is in a good state of development.

At a local regional level, the efficiency of sports venue resource allocation varies significantly between the eastern, central, and western regions of China, with significant stratification. Although there are large regional differences, all regions are developing well and are on an upward trend. However, because of the different development bases of sports venue resources and the degree of combination of various production factors in the three regions, the average growth rates of the three regions varied significantly, with the average growth rates of the three regions in the East, Central, and West being 4.8%, 2.6%, and 8.0%, respectively, during the examination period. During the examination period, the efficiency of the eastern region was significantly better than that of the central and western regions. The difference in efficiency between the central and western regions changed over time and gradually decreased. Taking the national efficiency of sports venue resource allocation as the benchmark, only the efficiency of the eastern region was higher than the national efficiency average, while the remaining two regions were lower than the national average. At the national level, although the national sports venue resource allocation level reaches 0.826, there is a high degree of regional differentiation in the allocation of sports venue resources in China. The average efficiency of sports venue resource allocation in the three major regions generally shows a spatial distribution pattern of "east > central > west."

At the provincial, municipal, and autonomous region level, the provinces, municipalities, and autonomous regions with high sports venue resource allocation rates during the study period were Beijing, Tianjin, Hebei, Shanghai, Jiangsu,

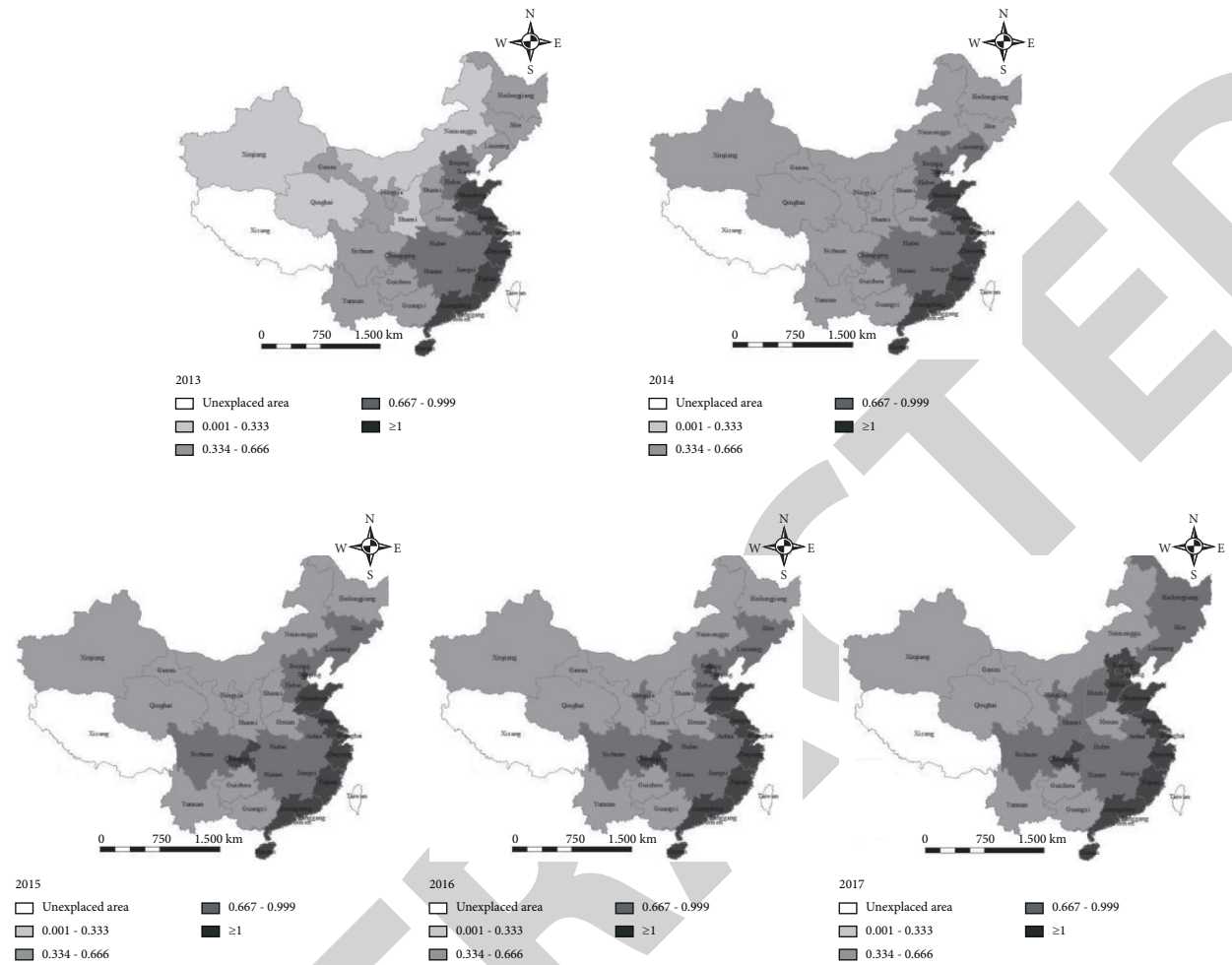

Figure 1: Visualization of the efficiency of sports venue allocation by provinces, cities, and autonomous regions in China.

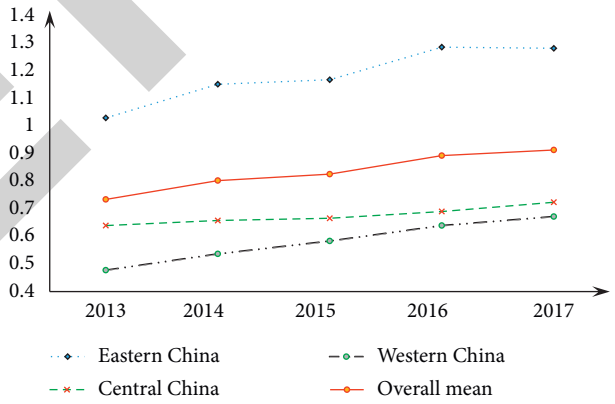

Figure 2: Trends in the average efficiency of sports venue allocation in the three major regions of China.

Zhejiang, Anhui, Fujian, Guangdong, Hainan, and Chongqing, with the above regions mainly coming from the Yangtze River Delta city cluster, Beijing-Tianjin-Hebei city cluster, the four municipalities directly under the central government, and some developed regions in southern China, all of which had efficiency averages above 0.8. Among them, Shanghai, Jiangsu, Zhejiang, Guangdong, Hainan, and Chongqing were all in the production effective frontier of sports venue allocation efficiency and maintained DEA effective during the period examined. Beijing, Tianjin, and Hebei were on the effective frontier most years and generally maintained high levels of efficiency in the allocation of sports venue resources. The regions with poor efficiency performance are Inner Mongolia, Qinghai, and Xinjiang, with efficiency values below 0.5 and far from the effective frontier, which is mainly because of local climatic conditions and

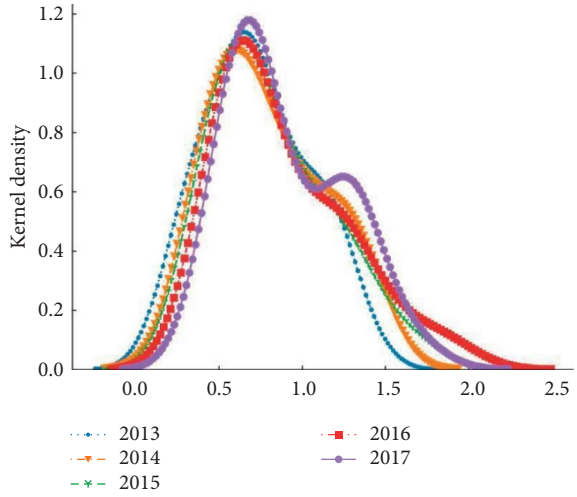

Figure 3: Kernel density estimation of site resource allocation efficiency for sports venues in China.

demographic factors. In terms of the trend of efficiency changes in each province, city, and autonomous region, the 30 provinces and cities studied in this paper generally maintained a slow growth trend from 2013 to 217. From the cross-sectional comparison of each province, city, and autonomous region, it can be seen that the standard deviation of the efficiency value of sports venues in each province, municipality, and autonomous region lies within the range of (0.3081, 0.3800), and the difference between the standard deviations is small, indicating a stable development of the efficiency of sports venue allocation in China. However, the difference between the maximum value and the minimum value is large, and there is more room for improvement in areas with low efficiency in the allocation of sports venue resources.

3.2. Evolutionary Characteristics of the Efficiency of Sports Venue Resource Allocation. Figure 3 presents a two-dimensional plot of the kernel density estimates of the efficiency of sports venue resource allocation in China from 2013 to 2017. The kernel density analysis is presented below in terms of the position, shape, and kurtosis of the curves in the graph.

In terms of position, the opening and closing values of the kernel density curve for 2013 to 2017 show an overall "rightward shift" trend, with a relatively stable position of the density function. The center of the kernel density curve did not change significantly during the period under examination, however, there were significant differences between the zones of variation, indicating large regional differences.

In terms of shape, the kernel density curve from 2013 to 2016 roughly shows a single-peaked distribution, exhibiting a higher level of agglomeration. However, in 2017, the allocation efficiency of sports venue resources showed a significantly skewed distribution, and the shape of the curve did not show a strict single-peaked shape, however, a multipeaked pattern and the sum density corresponding to the first wave was much higher than the nuclear density corresponding to the other

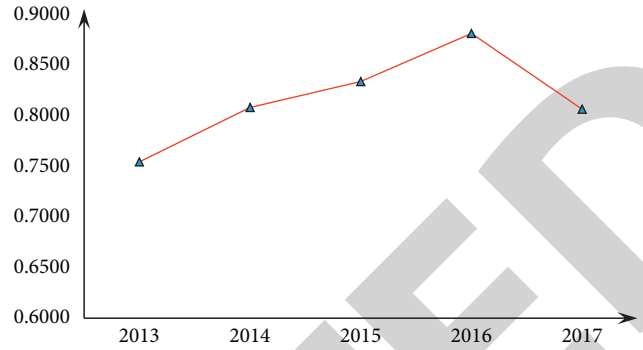

Figure 4: Polarization index of the efficiency of the allocation of sports venues in China.

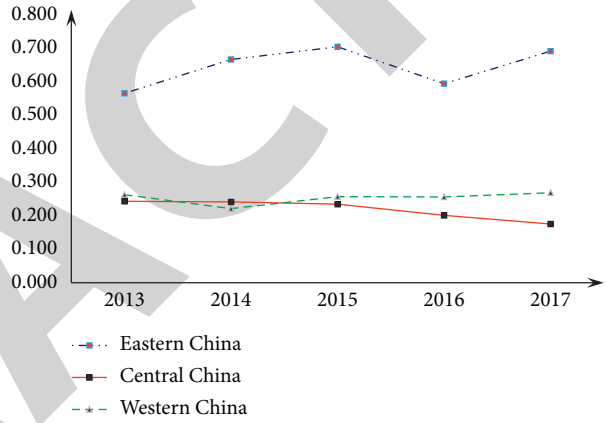

Figure 5: Polarization index of the efficiency of the allocation of sports venues in the three major regions of China.

wave peaks. The above analysis shows that the proportion of provinces, municipalities, and autonomous regions with relatively low efficiency in allocating sports venue resources is much higher than the proportion of provinces, municipalities, and autonomous regions with relatively high efficiency in allocating resources. The kernel density curve for 2017 shows a clear bimodal distribution compared to the other years examined, with fewer areas clustered with low values and more areas clustered with high values. It shows a certain degree of "club convergence," however, the degree of regional differentiation is still high.

In terms of kurtosis, the distribution of sports venue resource allocation efficiency in all provinces, municipalities, and autonomous regions in China during the period under examination shows a spike characteristic, with a clear form of spike performance. Compared with the wave height in the rest of the years examined, the wave height in 2017 was significantly higher, and the area of the allocation efficiency of sports venue resources in each province, city, and autonomous region corresponding to each wave increased.

3.3. Spatial Polarization Analysis of the Efficiency of Sports Venue Resource Allocation. Figure 4 expresses the development trend of the Esteban-Ray index of sports venue resource allocation efficiency for each province, city, and autonomous region in China from 2013 to 2017. To deepen

the understanding of the ER index of sports venue resource allocation efficiency in China, the ER polarization index of sports venue resource allocation efficiency in the three major regions of China (eastern region, central region, and western region) were studied separately, and the ER indices of the three major regions are shown in Figure 5.

From 2013 to 2017, ER ϵ [0.7517, 0.8028] for the allocation efficiency of sports venues in China, with the ER index taking values closer to 1, which indicates a high degree of polarization. The polarization index showed a trend of "fluctuating upward and then slowly decreasing" during the period under study. The above analysis indicates that the efficiency of the allocation of sports venue resources in China evolved from regional agglomeration to regional equilibrium during the study period.

Looking specifically at the three regions of East, Central, and West China, the ER index evolved differently in each of the three regions over the period examined. The average growth rate of the ER index for the efficiency of sports venues in the east, west, and central regions is 4.46%, 8.53%, and −5.61%, respectively, with the ER index in the east showing an "N-shaped" evolution, specifically the amplitude of increase and decrease changes. The ER index in the western region changed to a lesser extent from 2013 to 2014, and the ER index in the region was stable from 2014 to 2017. The ER index in the central region showed an evolutionary trend of decreasing year by year, and from 2013 to 2015, the ER index values in the central and western regions were less different from the evolutionary trend. Index values and evolutionary trends differ to a lesser extent, with significant differences in efficiency values between the two regions in 2015–2017.

From 2013 to 2017, the ER index of the allocation efficiency of sports venues in the eastern region was higher than that in the central and western regions. In the west, the ER index of sports venue resource allocation efficiency was lower than that of the central region only in 2014, while the ER index of sports venue resource allocation efficiency was higher than that of the west at other points in time, thus showing a spatial pattern of "east > central > west" from 2014 to 2017. Allocation efficiency refers to the optimal combination of input factors to produce the optimal product quantity combination. Under the condition of constant input, through the optimal combination and effective allocation of resources, efficiency will be improved and output will increase.

4. Conclusions and Insights

The efficiency of sports venue resource allocation in China generally shows a fluctuating upward trend, with significant and gradually increasing differences among the three major regions. The development of the sports economy and related industries has led to frequent adjustments in the total amount of skilled personnel, capital investment, and the structure of the sports industry in different regions of China. It maps onto the basic carrier of sports venue development—the allocation of sports venue resources. Changing the material circulation path within the sports venue resource allocation system and the information exchange mechanism with the external system eventually leads to fluctuations in the trajectory of changes in the efficiency of China's stadium venue resource allocation and the heterogeneity of its overall distribution state. According to the GIS visualization results and the results of sports venue resource allocation efficiency, the growth change rate of China's sports venue resource allocation efficiency between 2013 and 2017 is specifically shown as "+9%, 3%, 8%, 2%," indicating that the growth change index shows a trend of one high and one low change, and the efficiency growth index is unstable. At the level of provinces, municipalities, and autonomous regions, as well as at the level of the three regions of East, Central, and West, the efficiency of the allocation of sports venues shows a significant spatial unevenness. At the same time, compared with 2013, the range of changes in the kernel density curve of sports venue resource allocation efficiency in 2017 is significantly larger, and the regional gap has widened.

The polarization of the efficiency of the allocation of sports venues in China has become apparent. In general, the polarization curve is in the shape of "∧", i.e., a trend of growth followed by a decline. Because of the unique socioeconomic attributes of sports venues, the overall distribution pattern of the allocation efficiency of sports venue resources is susceptible to the interference of external factors, such as regional economic development and local land policies, and thus shows instability. Especially in the context of regional economic development polarization, the evolution of the sports venue resource allocation system has also shown significant polarization. The analysis of the literature review shows that regional economic development is one of the main influencing factors on the allocation of sports venue resources, thus making the degree of polarization and the specific path of polarization vary from region to region. The results of the Esteban-Ray index show that the polarization index of the efficiency of the allocation of sports venues in China and the three major regions have different trends over the period examined, with the polarization index of the efficiency of the allocation of sports venues in China showing "∧" pattern, while that of eastern China showing an "N" pattern of "rising-falling-rising." Central China shows a slow decline year by year, with an average rate of change of only 6%. Western China shows no significant change and is basically stable. It shows that the regional changes in eastern China play a dominant role in the polarization of the overall efficiency of the allocation of sports venues in China. At the same time, there are obvious differences in the degree of polarization among the three regions, showing obvious stage characteristics.

This paper considers China's sports venue resource allocation system as a whole and examines the regional heterogeneity and polarization pattern of China's sports venue resource allocation efficiency during the period under study. In the process of spatial pattern evolution, excessive polarization of sports venue resource allocation should be avoided as far as possible, and a diversified production factor communication mechanism should be constructed in terms of land resource endowment, capital investment, and local

economic development in different regions, so as to give full play to the energy diffusion effect of the high-level development area of the urban construction land system on the peripheral areas. It should also analyze the path of energy-level upgrading of sports venue resource allocation efficiency in noncore or peripheral areas through industrial structure upgrading, land management system innovation, and legal and rational use of government policies to find the optimal upgrading path. To ensure the rationality of the allocation pattern of production factors in different regions and the allocation of factors at different stages of development in the same region, efforts should be made to narrow the regional differences in the allocation efficiency of sports resources because of economic, social, and natural environment factors, and to promote the balanced development of each region as a whole [26, 27].

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Disclosure

Jian Cao and Jie Geng are co-first authors.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

Authors' Contributions

All authors have seen the manuscript and approved to submit to your journal.

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