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Original Research

The Impact of the COVID-19 Epidemic on China's High-Level Tourist Attractions: Evidence from Jiangsu Province

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Abstract

Based on the data from high-level scenic spots in Jiangsu Province in 2020 after the outbreak of the epidemic, this paper uses the geographic space method to display the temporal and spatial change process of the number of tourists in scenic spots during COVID-19, and establishes a multivariate lag nonlinear regression model to empirically study the mechanism of changes in the number of tourists in tourist attractions during the epidemic. The results show that: (1) Except for the restrictions such as closing the park, after the outbreak of COVID-19, the number of tourists in the scenic spots has recovered, and the recovery speed of different types of scenic spots is different. Tourists in cultural scenic spots and modern amusements are recovering slowly, and they are less resilient due to the impact of the epidemic. (2) The situation of the COVID-19 epidemic and related public opinions have an impact on the number of tourists in the scenic spot. The degree of impact from large to small is the number of newly diagnosed domestically, the public opinion index of COVID-19, the number of newly imported overseas, and the number of newly diagnosed overseas. From the perspective of time, the number of newly diagnosed domestic and foreign epidemics has a significant inhibitory effect on the number of tourists in the scenic spot before June 2020, and the impact is not obvious after June, while the number of newly imported overseas cases and the epidemic public opinion index have a significant long-term negative effect on the number of tourists in the scenic spot (3) The time lag days for the impact of COVID-19 on the number of tourists in scenic spots are usually 1-2 days, and as the event progresses, the time lag is extended to 3-4 days, reflecting that tourists are less sensitive to COVID-19. Events such as holidays and other events can also dramatically alter the impact of the COVID-19 pandemic. (4) The differentiation, volatility, and lag of the impact of COVID-19 on tourist attractions stem from the impact of the epidemic on tourists' travel motivation. In the repeated epidemic environment, tourists' travel is affected by the distance between the epidemic site and the tourist location, and tourists are

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more inclined to open, and close-up scenic spots. To sum up, natural and ecological scenic spots should actively seize the opportunity for recovery and speed up the pace of recovery. Historical, cultural, and modern recreational scenic spots need to wait for the opportunity and make good use of holidays to drive recovery through marketing strategies; areas far away from the epidemic should pay attention to tourists. It is necessary to take decisive measures to close the park during the outbreak of the epidemic in order to avoid the danger caused by lag.

Keywords: tourist volume in tourism attractions, COVID-19 epidemic, tourism crisis, multiple nonlinear regression, kernel density

Introduction

China's tourism industry is a strategic pillar industry of the national economy, and the comprehensive contribution of tourism to GDP exceeds 11%. The proportion of the employed population in the country exceeded 10%, which played a significant role in promoting stable growth, stable investment, stable employment, and promotion costs [1]. At the beginning of 2020, the COVID-19 pandemic broke out worldwide. The resources, channels, services, and sales of the domestic tourism industry have been affected to varying degrees [2]. In 2020, the number of domestic tourists in China was 2.879 billion, 3.022 billion fewer than in the same period last year, down 52.1%. Domestic tourism revenue was 2.23 trillion yuan, a decrease of 3.50 trillion yuan, or 61.1%, over the same period last year. In 2021, according to the Annual Report on China's Domestic Tourism Development 2021 released by the China Tourism Academy, the number and income of domestic tourism are expected to recover to 65% and 58% of the same period in 2019. In the context of the normalization of epidemic prevention and control, it is an indisputable fact that domestic tourism will be affected by the novel coronavirus epidemic for a long time. Therefore, it will play a key role in the survival and rejuvenation of tourist attractions and even the tourism industry during the epidemic period to summarize the changes in tourists in tourist attractions since the epidemic, explore the mechanism of the impact of the epidemic on tourist attractions, and provide targeted solutions and suggestions for the recovery of tourist attractions. The COVID-19 pandemic is a tourism crisis for the travel industry. A tourism crisis is an unexpected event that affects tourists' confidence in a destination and disrupts the continuation of normal business [3, 4]. Since the reform and opening up, China's tourism industry has experienced nearly 10 tourism crises with great impact, such as the catastrophic flood in 1998, the "SARS" in 2003, and the Wenchuan earthquake in 2008 [5]. Scholars have also carried out a large number of studies on the tourism crisis, mainly focusing on the descriptive study of case places [6], the simulation and prediction study based on mathematical modeling [7-11], and the study on the impact mechanism of the tourism crisis [12-17]. As a tourism crisis, the novel coronavirus pandemic is special because of its extraordinary persistence and large-scale social impact, so the following issues need to be addressed: (1) Differential characteristics of the impact of COVID-19 on tourist attractions. (2) Mechanisms of the impact of COVID-19 on tourist attractions. (3) Recovery strategies for different types of tourist attractions under the impact of COVID-19.

This paper studies the above issues based on the tourist data of high-level tourist attractions in Jiangsu Province after the COVID-19 epidemic in 2020. High-level scenic spots refer to the national AAAAA level and national AAAA level scenic spots, which play a leading role in the national A-level scenic spots and represent the recovery level of the industry to a certain extent. At the same time, as a key indicator to reflect the operation of scenic spots, the number of tourists can directly quantify the recovery of tourism after the epidemic. Taking high-grade scenic spots in Jiangsu Province as an example, this paper used the kernel density method to analyze the spatio-temporal change process of tourist volume during the epidemic period, established a multiple lag nonlinear regression model to empirically analyze the change mechanism of tourist volume during the epidemic period, and the differentiation, volatility, and lagging characteristics of the impact of COVID-19 on tourist volume in tourist attractions. It provides references for the development of tourist attractions and the full recovery of tourism during the normalization of the epidemic, and it also takes the novel coronavirus epidemic as a case to supplement the research on the tourism crisis.

Material and Methods

Case Selection

Jiangsu Province is located in the Yangtze River Delta region of China, which has a developed economy, a dense population, and a high level of tourism development. The number of tourist attractions in Jiangsu Province is rich and diverse, and the number of high-grade scenic spots ranks among the top in the country. During the epidemic, Jiangsu's tourism industry recovered well. In 2020, Jiangsu received a total of 473 million tourists and achieved a total tourism revenue of 825.059 billion yuan, recovering to 53.7 percent

and 57.6 percent in 2019, respectively. The recovery degree of domestic tourist arrivals and domestic tourism income is 5.9 and 19.6 percentage points higher than the national level, respectively [18]. The impact of the COVID-19 outbreak on Jiangsu Province has been relatively small. All regions in the province have been affected by the epidemic to a similar degree. Therefore, the tourism crisis environment of all scenic spots can be regarded as the same, which can better analyze the differentiated characteristics of the impact of COVID-19 on tourist attractions. The case of high-grade scenic spots in Jiangsu Province is more typical.

Research Methods and Data Sources

Nuclear Density Analysis

Kernel density analysis can be used to analyze the distribution probability of the research object and its spatial aggregation degree. This paper analyzes the trend of tourist volume change in tourist attractions under the epidemic situation by means of nuclear density. The formula for nuclear density analysis is expressed as follows:

$$f(s) = \sum_{t=1}^{n} \frac{1}{h^2} k\left(\frac{s - c_i}{h}\right) \quad (1)$$

Where f(s) is the kernel density calculation function at the spatial position s, h is the distance decay threshold, k() is the kernel function, and S-c_i is the distance from the estimated point s to the sample point c_i.

Multiple Linear Regression Model

The multiple linear regression equation is a model based on the basic principle of least square fitting, which is used to judge the impact of multiple variables on a certain variable. The formula is as follows [19]:

$$Y = \sum \beta_i x_i + \alpha \quad (2)$$

Where Y is the dependent variable, β_i is the coefficient of the explanatory variable, x_i refers to the explanatory variable, and α is the constant term.

Because the relationship between objective things is not necessarily linear, this paper introduces multiple nonlinear regression methods to construct a nonlinear function on the basis of traditional linear regression analysis in order to deal with complex practical problems. In addition, since the impact of COVID-19 on tourism activities may have a time lag, this paper mainly refers to the multiple time-delay nonlinear regression model with a time lag term constructed by Yang et al. [20].

Data Sources and Data Processing

The data on tourists and areas of scenic spots come from the statistics of the national A-level scenic spot management system of the Ministry of Culture and Tourism of the People's Republic of China. The data on newly confirmed domestic epidemics, newly imported overseas epidemics, and newly confirmed foreign epidemics are derived from the Baidu Real-time Big Data Report on Epidemics. The public opinion on the epidemic is explained by the Baidu index, which comes from the Baidu index of the "COVID-19" entry. With the popularity of the Internet, users use search engines to obtain travel-related information at the same time. The search engine will also store this information in the database, and through keyword extraction, frequency calculation, and weighted summing resulting in the search index, the Baidu index becomes China's largest search engine. Baidu's statistical analysis platform can vividly reflect the daily change trend of the keyword in the form of a graph. To a certain extent, the Baidu Index represents potential tourists' attention to the epidemic, which is the leading condition for tourism motivation and behavior, and can better reflect the characteristics of tourism demand and regional differences. The per capita GDP of the city where the scenic spot is located comes from the 2019 Statistical Bulletin of the National Economic and Social Development of Jiangsu Province, and the population data comes from the Jiangsu Provincial Bureau of Statistics.

Excluding the scenic spots that were not opened or whose statistical caliber changed during the epidemic period, the study object consisted of 171 high-grade scenic spots. Considering that most scenic spots are closed before February 19, this paper selects the daily tourist volume data of high-grade scenic spots in Jiangsu Province from February 20 to December 31. 2020, and the scenic spot data of the same period in 2019. In order to calculate the comparison data between the tourist volume during the epidemic period and the tourist volume in 2019, the tourist volume in 2019 and 2020 are aligned in the unit of "week" according to the cycle law of tourist travel [21].

Results and Discussion

Differences in the Impact of COVID-19 on Tourist Attractions

Three indicators were selected: tourist volume (monthly tourist volume), tourist recovery ratio (monthly tourist volume compared with 2019 tourist volume), and tourist recovery rate (monthly tourist volume compared with every 3 months). The relevant data of high-grade scenic spots in Jiangsu in March, June, September, and December 2020 were visually analyzed using the nuclear density analysis method (divided into 9 grades by the Jenks natural fracture classification method, and 0 values were excluded from the

classification).

Tourist Volume of Scenic Spots

The tourist volume in 2019 was introduced as the control group, and the changes in tourist volume in high-grade scenic spots in Jiangsu Province during the epidemic period were compared and analyzed, and the spatial-temporal changes of tourist recovery in high-grade scenic spots in Jiangsu Province are shown in Fig. 1. During the epidemic period, the number of tourists in Jiangsu Province has always been shown as the southern Jiangsu gathering in Nanjing (Fuzimio-Qinhuai Scenic Belt) and Wuxi (Yuantouzhu Scenic Spot), and the spatial structure of tourist distribution in the scenic spot is basically the same as that in 2019. From the perspective of time sequence changes, in March, some scenic spots were still closed, and the overall tourist volume of high-level scenic spots in the province was less, and the tourist volume of southern scenic spots was higher than that of central and northern scenic spots. In June, the number of tourists in high-level scenic spots in the province doubled compared with March, and the number of tourists in central and northern Jiangsu scenic spots increased relatively. In September, the number of tourists in high-level scenic spots in the province was the largest, and the spatial pattern of tourist distribution was close to that in 2019. In December, due to the seasonal impact, the number of tourists in high-level scenic spots in the province decreased compared with September.

Recovery Ratio of Scenic Tourists

In order to analyze the degree of tourist recovery of scenic spots, the spatial and temporal variation of the tourist recovery ratio of high-level scenic spots in Jiangsu Province was compared with that of 2019 during the epidemic period, as shown in Fig. 2. In March, only a few scenic spots, such as Weishan Lake Thousand Island Wetland, Xuanshui Lake, Gaochun Old Street Historical and Cultural Scenic Spot, Erlangshen Cultural Relic Park, Huaguo Mountain, and Haohe, had a good recovery. In June, Geyuan, Songjiacheng Scenic Spot, Hanshan Temple, and other scenic spots began to make efforts to catch up with Weishan Lake, Thousand

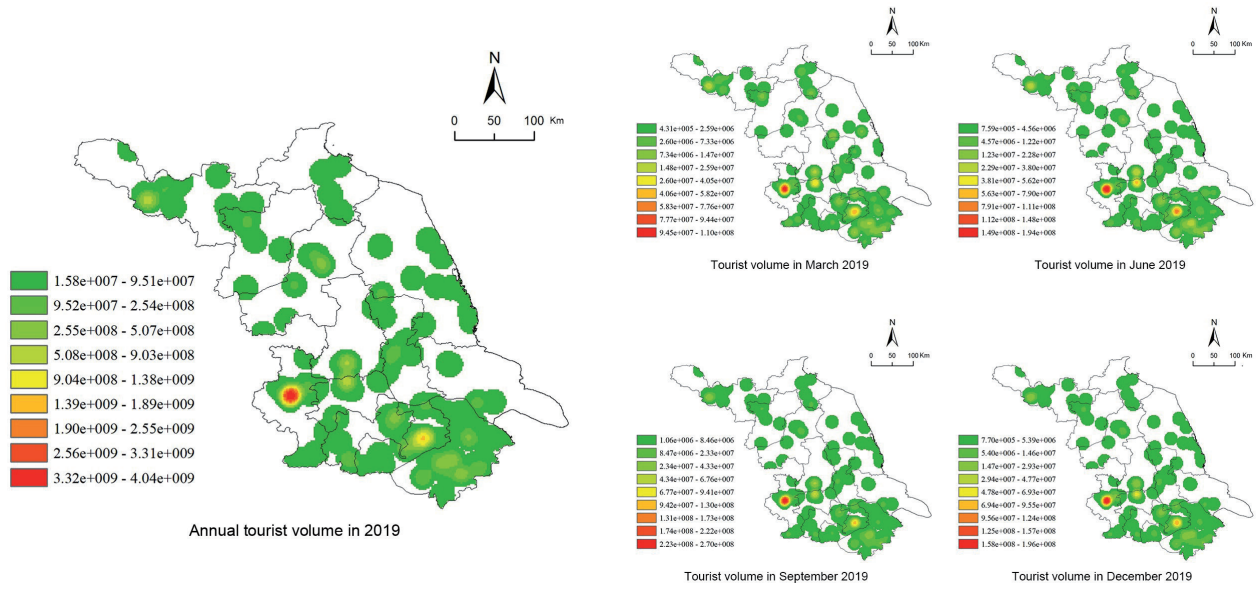

Fig. 1. Number of tourists in COVID-19.

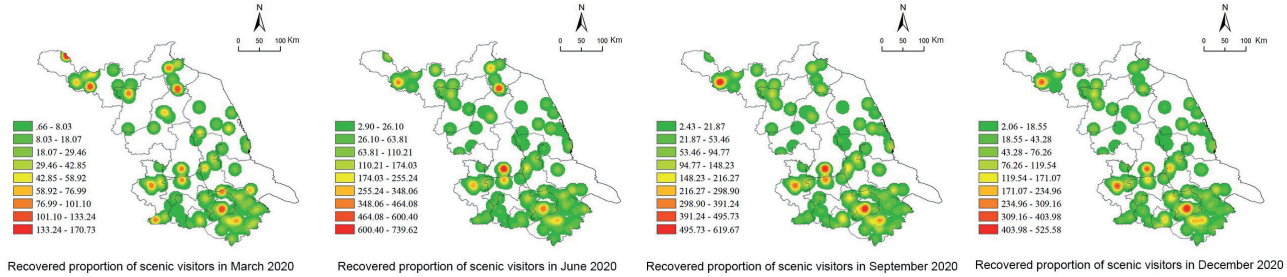

Fig. 2. Rate of tourist recovery

Island Wetland, and other scenic spots, becoming a new growth point for the restoration of scenic spots. From September to December, the recovery of all scenic spots in the province tended to be good and the recovery ratio of tourist volume in scenic spots eventually formed a relatively fixed spatial pattern.

In order to analyze the differentiated impact of COVID-19 on tourist attractions, according to the classification criteria of tourist attractions in the 2019-2020 China Tourist Attractions Development Report issued by the Department of Resources Development of the Ministry of Culture and Tourism of the People's Republic of China, High-grade scenic spots in Jiangsu Province selected in this paper are divided into historical and cultural categories, natural ecology categories, modern entertainment categories and industrial integration categories (the number of industrial integration scenic spots is too small, which will not be discussed in this paper), and the tourist volume of different types of scenic spots is compared with the tourist volume in 2019, and the spatial-temporal change of tourist recovery ratio of different types of scenic spots is shown in Fig. 3. In March, the recovery of tourists of natural ecological scenic spots was better than that of modern amusement scenic spots and historical and cultural scenic spots, and the recovery of all natural ecological scenic spots was close, except for the Thousand Island Wetland scenic spot of Weishan Lake, where no obvious recovery growth point was seen. In June, the recovery of tourists in historical and cultural scenic spots improved significantly, and the recovery ratio exceeded that of natural ecology and modern amusement spots. From September to December, the recovery of historical and cultural scenic spots was still in the lead, and the recovery of natural ecological scenic spots was worse than the improvement, while the recovery of modern amusement scenic spots showed a good trend, considering that it was related to tourism seasonality and holiday tourism activities.

Recovery Speed of Scenic Tourists

The temporal and spatial variation of tourist recovery speed at high-grade scenic spots in Jiangsu Province is shown in Fig. 4 by calculating tourist volume from March to June, June to September, and September to December. From March to June, Huishan Ancient Town, Chinese Filial Piety Garden, and other scenic spots had a faster recovery speed, while the other scenic spots had a similar recovery speed, and the recovery speed of all regions in the province was more balanced. From June to December, the recovery speed of scenic spots slowed

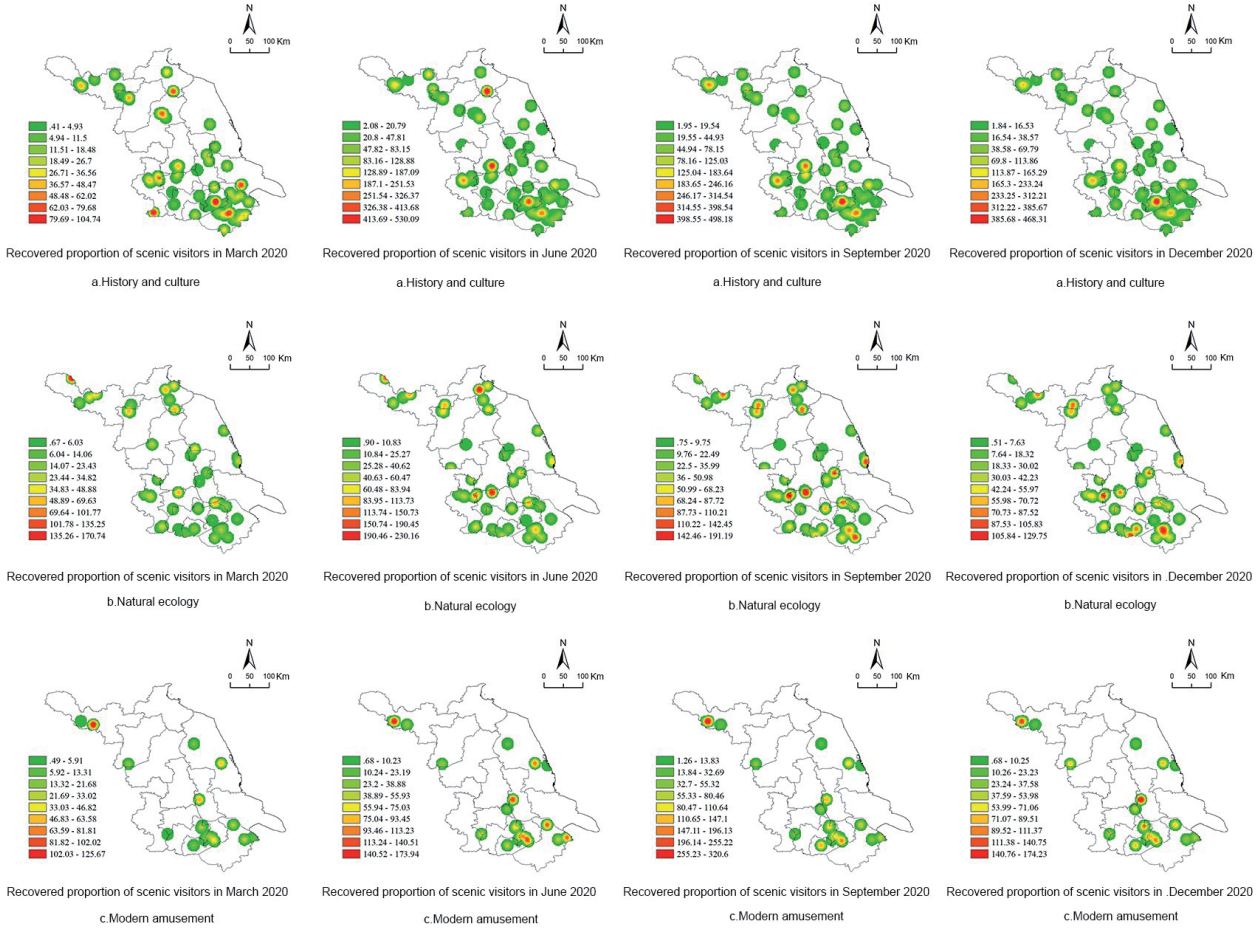

Fig. 3. Rate of tourist recovery in different types of scenic spots.

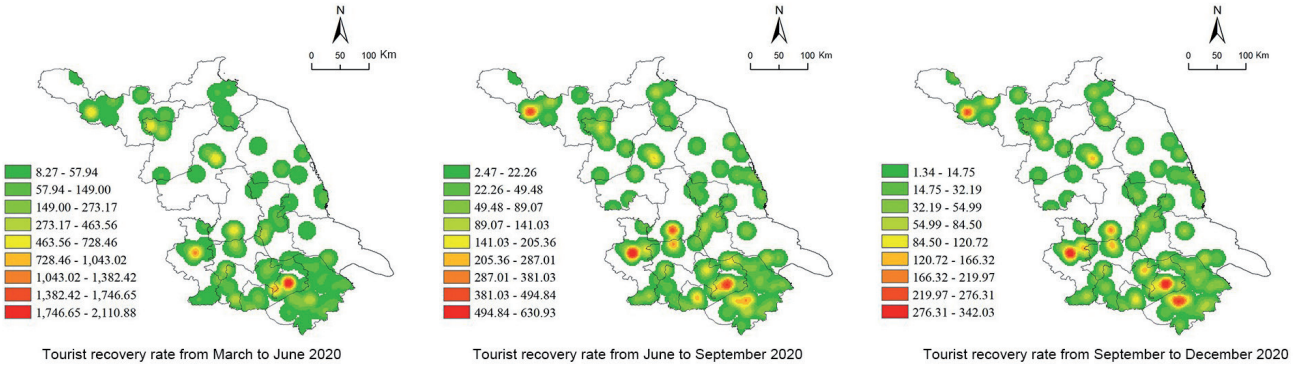

Fig. 4. Speed of tourist recovery.

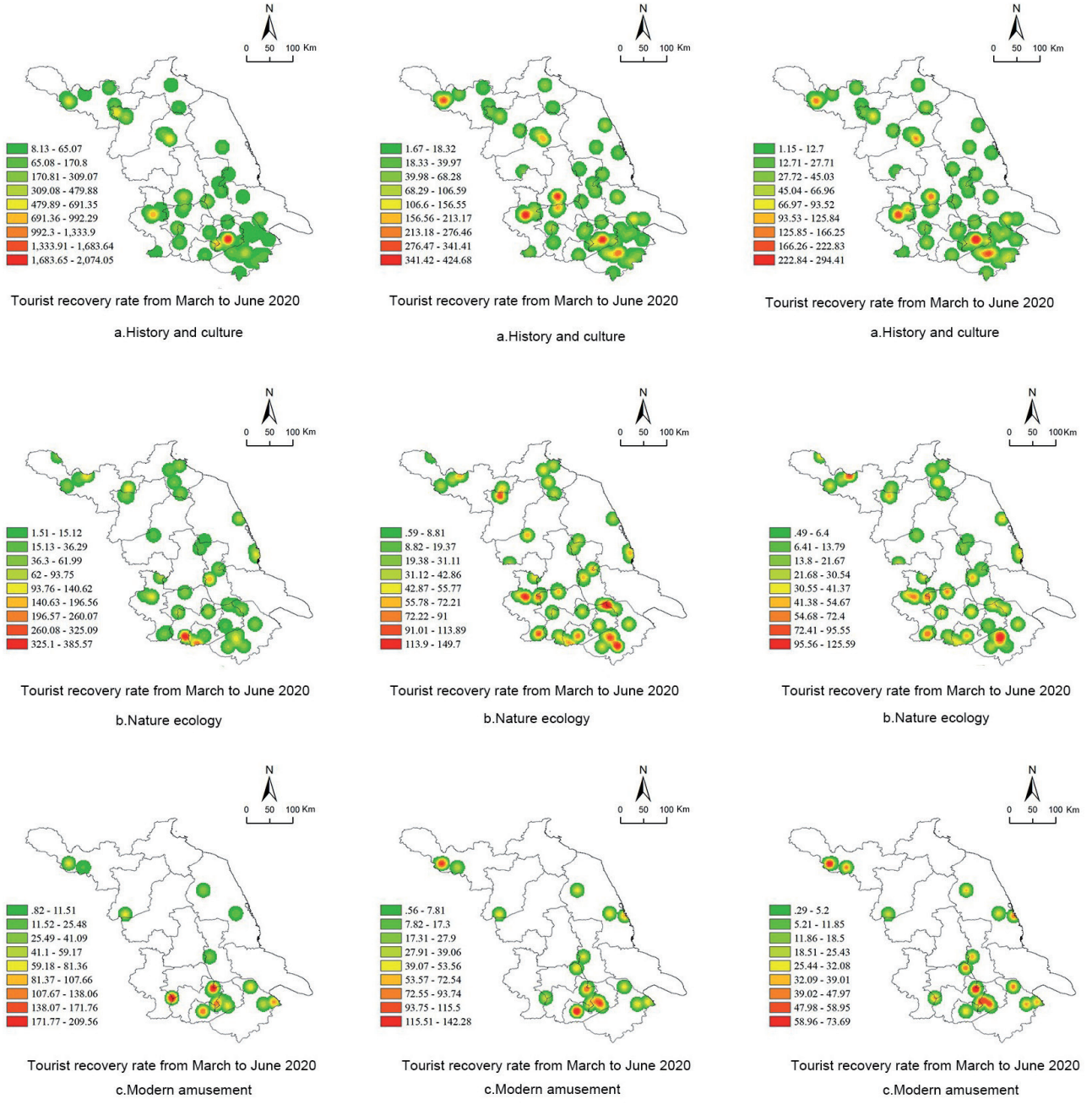

Fig. 5. Speed of tourist recovery in different types of scenic spots.

down overall, and the recovery speed of southern Jiangsu scenic spots was relatively fast.

The spatial-temporal variation of tourist recovery speed in different types of scenic spots is shown in Fig. 5. The recovery speed of different types of tourist attractions showed a slowing trend. From March to June, the recovery speed of historical and cultural scenic spots was faster and several times faster than that of other types of scenic spots. From June to December, the recovery rate of tourists in historical and cultural scenic spots fell rapidly, but it was still at a leading level. On the whole, the recovery speed of historical and cultural scenic spots is fast, but the stability is poor, and the recovery rate of tourists in natural ecological scenic spots is relatively slow, but the overall trend is stable. The recovery speed of tourists in modern amusement scenic spots is the slowest, and its stability is moderate.

Mechanisms of the Impact of COVID-19 on Tourist Attractions

Research Hypothesis and Model Construction

Propose Hypotheses

According to the above research, the recovery rate and recovery speed of different scenic spots vary greatly during the epidemic period, and such differences are related to the types of scenic spots. It is speculated that the COVID-19 epidemic will not only affect tourists' travel motivation, but also tourists' destination choice preferences to a certain extent. Existing studies have shown that COVID-19 has a significant impact on the economy [22], transportation [23], and residents' consumption habits [24]. In order to further analyze the possible impact of COVID-19 on tourists' tourism activities, keyword analysis, and text analysis were carried out on online travel notes and tourists' evaluations during the epidemic period. Using "COVID-19" as the keyword to search questions and travel notes, it was found that during the COVID-19 pandemic, the main concerns of tourists were "will there be a danger?", "has the hotel been used as a quarantine hotel?", "there are no COVID-19 patients in the destination", etc. The main reasons for tourists to travel include "stay at home for a long time, want to go out to relax", "breathe fresh air", "shorter and safer journeys", "low-risk travel", and so on. On the whole, the direct impact of COVID-19 on tourist attractions is tourists' concern about the potential epidemic risk in the tourist source, journey, and destination. On the other hand, the difference in destination choice caused by the change in tourist motivation is an indirect influence. Combined with the research on risk perception theory and impact factor analysis [25, 26], the following hypothesis is proposed for the change in tourist volume in scenic spots during the epidemic period:

Hypothesis H1-0: The COVID-19 epidemic has a significant direct impact on tourist attractions;

Hypothesis H1-1: The number of tourists in scenic spots is related to the impact scale of the COVID-19 epidemic event;

Hypothesis H1-2: The tourist volume of the scenic spot is related to the public opinion dissemination of the COVID-19 event;

Hypothesis H2-0: The COVID-19 epidemic affects tourists' preference for scenic spots and has an indirect impact on tourist spots;

Hypothesis H2-1: During the COVID-19 pandemic, tourists tend to travel to destinations with lower

Table 1. Explanatory variables of COVID-19's influence on tourist volume.

Primary variable	Secondary variable	Variable description	Symbol
Hypothesis 1	Tourist volume in 2019	Reflect on the status of tourist volume in scenic spots without the impact of an epidemic	A1
	Newly confirmed cases of COVID-19 in China	Reflect on the impact of the domestic epidemic situation on the tourist volume of scenic spots	B1
	Newly confirmed cases abroad	Reflect on the impact of foreign epidemic situations on the tourist volume of scenic spots	B2
	New overseas imports	Reflect on the impact of an inbound epidemic situation on the tourist volume of scenic spots	B3
	Epidemic Baidu Index	Reflect on the impact of public opinion dissemination of the epidemic on the tourist volume of the scenic spot	B4
Hypothesis 2	Per capita GDP of the city	Reflect on the influence of regional economic development levels on the tourist volume of scenic spots	C1
	Population of the city where the scenic spot is located	Reflect on the impact of the regional population and potential markets on the tourist volume of scenic spots	C2
	Area of scenic spot	Reflect on the impact of the safety environment on the tourist volume of scenic spots	C3

Note: The Baidu index refers to the degree of internet users' attention to key words;
Data scale is daily data.

economic levels in their jurisdictions;

Hypothesis H2-2: During the COVID-19 pandemic, tourists tend to travel to destinations with small populations in their jurisdictions;

Hypothesis H2-3: Tourists tend to prefer larger destinations during the COVID-19 pandemic.

In order to verify the above hypothesis, a relationship model between tourist volume and influencing variables was constructed during the epidemic period. Taking the daily tourist volume of scenic spots during the epidemic period as the dependent variable, the tourist volume of scenic spots in 2019 was introduced to reflect the change in tourist volume of scenic spots without the impact of the epidemic. The number of newly confirmed COVID-19 cases at home and abroad and the number of newly imported cases overseas were introduced to reflect the situation and impact of the COVID-19 epidemic. The Baidu index of the COVID-19 epidemic was introduced to reflect the impact of public opinion of the epidemic on the tourist volume of scenic spots. The per capita GDP of the city where the scenic spot is located, the population of the city where the scenic spot is located, and the area of the scenic spot are introduced to reflect the changes in tourists' destination choice preferences under the COVID-19 epidemic. Explanatory variables are summarized in Table 1:

Model Construction

According to the background trend line theory [9], the number of tourists in 2019 (A1) is linearly correlated with the number of tourists in 2020. COVID-19 has a direct impact on tourism motivation and tourism behavior, and there is a time lag between COVID-19 and tourists' tourism activities. Therefore, there was a negative linear correlation between the number of newly confirmed cases (B1-B4) and tourist volume with a time delay. Under the influence of COVID-19, tourists tend to prefer tourism activities with less risk when making tourism decisions. The original correlation between tourist volume of scenic spots, per capita GDP, population, and area of scenic spots has changed. Based on the marginal effect theory and the reality of the logistics curve of COVID-19 transmission [27], explanatory variables C1-C3 and dependent variables should be nonlinearly correlated. Common nonlinear functions such as exponential functions, logarithmic functions, and power functions were tested by the exhaustive method. Finally, the inverse proportional function of the power function was selected as the fitting function of C1-C3 variables, and the multivariate nonlinear time lag model of tourist volume recovery in tourist attractions during the COVID-19 outbreak with a time lag term was constructed, as shown in Formula 4:

$$Y_t = \alpha_1 A_t + \sum_{j=0}^{n} \beta_j B_{t-j} + \gamma_1 / C_1 + \gamma_2 / C_2 + \gamma_3 / C_3 + \varepsilon \quad (4)$$

Where Y represents the daily tourist volume of high-grade scenic spots in Jiangsu Province during the epidemic period, αi, βi, and γi are all parameters, Ai, Bi, and Ci correspond to explanatory variables in Table 1, t represents the t day, j represents the order of lag (i.e., the number of lag days), and ε is a constant term.

Dimensionless processing was carried out on the above variable data, and the rationality of the modeling was tested: (1) The Pearson correlation coefficient was used to test whether there was multicollinearity among explanatory variables. Among the B1-B4 variables, the absolute value of the correlation coefficient between the number of new overseas imports and the public opinion of the epidemic is the highest at 0.56, and the absolute value of the correlation coefficient between the C1-C3 variables is the highest at 0.42. There is no multicollinearity problem among the explanatory variables. (2) In order to test the rationality of the time lag term, the ADF method was used to conduct the unit root test for B1-B4 variables [28, 29] with reference to the application conditions of the autoregressive lag model. At the significance level of 0.05, variables B1 and B3 were stationary series, and variables B2 and B4 were first-order stationary series, and there was a cointegration relationship with the explained variables. The regression can be carried out directly, and the rationality of the model estimation with a time delay term is tested. (3) There may be endogeneity problems between explanatory variables C1-C3 and dependent variables. Based on the idea of natural experiments [30], taking tourist volume in 2019 as the control group, the relationship between variables C1-C3 and tourist volume in scenic spots in 2019 was tested. Variable C1-C3 showed a weak positive correlation with tourist volume in scenic spots in 2019.

Hypothesis Testing

In the MatlabR2019b environment, the multiple regression model with time delay is fitted and analyzed in months. The upper limit of time delay is set at 7 days, the optimal solution of R^2 is selected as the final regression model, and the relationship model between various factors and the tourist volume of high-level scenic spots in Jiangsu Province during the COVID-19 outbreak is obtained, as shown in Table 2:

The R^2 estimates in the above relationship equations all exceed 0.55, and the overall reliability is high. In general, the tourist volume of the scenic spot in 2019 (A1), the number of newly confirmed COVID-19 cases abroad (B2), the regional economic development level of the scenic spot (C1), and the area of the scenic spot (C3) were positively correlated with the tourist volume of the scenic spot during the epidemic period. The number of newly confirmed cases of the epidemic in China (B1), the number of newly imported cases from abroad (B3), the public opinion of the epidemic situation (B4), and the population of the area where the scenic spot is located (C2) were negatively correlated with the tourist

Table 2. Degree coefficient of COVID-19's influence on tourist volume.

Variables	Constant term	A1	B1	B2	B3	B4	C1	C2	C3	F statistic	T value	Time lag	R-statistic
Total	3205.57*	264044.06*	-4808.56*	6648.14*	-143.44	-4525.95*	-715.48*	387.70*	-0.000198611*	11939.94	109.27	1	0.68
February - March	-1132.10*	100391.93*	-490.73	-227191.17*	2828.67*	3159.99*	46.60	553.75	-0.00024507*	828.22	28.78	0	0.56
April	3008.77*	166993.03*	-1995.49	-29613.91*	-1017.75*	-1290.86	-171.71	96.44	-0.000166276*	1327.21	36.43	0	0.67
May	6494.73*	207087.94*	-45663.00*	-54135.27*	12627.28*	-11783.44*	-869.45*	148.53	-0.000218665*	1383.26	37.19	0	0.66
June	1994.33*	292635.60*	3107.98	-55489.56	536.35	-1851.51	-309.35*	514.32	-0.000109523*	2291.69	47.87	0	0.75
July	-1582.04*	326175.93*	6147.55*	16333.62	3115.36	-901.74	-276.18	855.27*	-0.000115243*	1909.39	43.70	0	0.72
August	4982.60*	340490.70*	9307.67	-16459.33*	-7261.67*	-18114.99*	-538.78*	704.86	-0.000189479*	2954.30	54.35	1	0.80
September	-2628.15*	383601.76*	67856.73*	56364.46	4333.41*	-1095.20*	-704.00*	505.15*	-0.000169409*	2131.19	46.16	3	0.75
October	4450.57*	381472.91*	65586.93*	7319.37	-10289.45*	-5141.52*	-1098.20*	290.38	-0.000170446	2185.93	46.75	0	0.74
November	1455.58*	465370.76*	1681.04	-1244.81*	-1123.32	-2823.64	-591.70*	443.85	-0.000146372*	2833.49	53.23	0	0.79
December	-1115.29*	321508.59*	5103.77	14013.99	3041.48	982.66	-820.38*	284.74*	-0.000192611*	1644.75	40.56	4	0.69

Note: "*" indicates that the value is significantly correlated with the dependent variable at the significance level of 0.05. All values except C3 take 2 decimal places.

volume of the scenic spot. Among them, the relationship coefficient between the tourist volume in 2019 (A1) and the tourist volume during the epidemic period can reflect the recovery of tourist volume in the epidemic period. Tourist areas are recovering well, and the number of visitors continues to rise (slightly down in December). The recovery speed is fast and then slow, which is consistent with the conclusion of the previous study.

The Direct Impact of COVID-19 on Scenic Spots

The number of newly confirmed COVID-19 cases at home and abroad, the number of newly imported COVID-19 cases (B1-B3), and the public opinion of the epidemic situation (B4) all have a negative impact on the tourist volume of scenic spots, and the influences on the tourist volume of scenic spots are as follows in descending order: The number of newly confirmed cases of the epidemic in China, the public opinion of the epidemic, the number of newly imported cases from abroad, and the number of newly confirmed cases of the epidemic in foreign countries. It indicates that the COVID-19 epidemic has a significant direct impact on the tourist volume of scenic spots, and the impact scale is different with H1-0 and H1-2 being tested. Public opinion (B4), as an important indicator reflecting the spread of public opinion about the epidemic, has an impact on the tourist volume of the scenic spot with H1-2.

From the change in the impact coefficient, the correlation coefficient between the number of newly confirmed cases of the epidemic (B1-B2) and the tourist volume of the scenic spot changed from negative (from February to May) to positive (from June). It indicates that the epidemic inhibited the growth of tourist volume in scenic spots before June 2020, so that the correlation coefficient between the number of epidemic cases and tourist volume in scenic spots was negative. After June, the impact of the epidemic on the tourist volume of the scenic spot weakened to the point where it was not obvious. Therefore, there was a positive correlation between the number of patients and the number of tourists. The correlation coefficient between the newly added overseas imports (B3) and the epidemic public opinion (B4) and the tourist volume of scenic spots fluctuates continuously, and most of them are negative, indicating that the newly added overseas imports and the epidemic public opinion have a relatively continuous negative impact on tourists' tourism activities.

To sum up, the COVID-19 epidemic has a sustained and fluctuating impact on scenic spots, which is related to the distance between the epidemic site, tourist destination, and tourist location. In addition, the public opinion of the COVID-19 epidemic is that virtual information makes tourists feel the physical distance, and the effect of information on tourists' travel is stronger than that of the inbound epidemic situation but less than that of the domestic epidemic situation.

Indirect Impact of COVID-19 on Scenic Spots

During the epidemic period, the regional economic development level (C1), the regional population (C2), and the area of the scenic spot (C3) were positively, negatively, and positively correlated with the tourist volume of the scenic spot, respectively, and the degree of impact was as follows in descending order: The economic development level of the region where the scenic spot is located, the population of the region where the scenic spot is located, and the area of the scenic spot are all important; that is, tourists tend to prefer the tourist spot with a better economic development level, a smaller population, and a larger area of the scenic spot. It has been proven that the above variables are usually positively correlated with the tourist volume of the scenic spot without the influence of the epidemic [31], so it is assumed that H2-0 and H2-2 are tested.

From the perspective of time change, the economic development level (C1) of the region where the scenic spot is located is positively correlated with the increase of the tourist volume of the scenic spot; the population of the region where the scenic spot is located (C2) is negatively correlated with the decrease of the tourist volume of the scenic spot; and the area of the scenic spot (C3) is positively correlated with the decrease of the tourist volume of the scenic spot. The relationship between the three variables and the tourist volume of scenic spots all changes with the passage of time. Combined with the practical basis that the impact of COVID-19 on tourist volume of scenic spots decreases with time, this coefficient change can be regarded as the process of tourists' destination choice preference change during the epidemic period. In other words, the more severe the epidemic, the more tourists tend to prefer scenic spots with relatively low economic development levels, a small regional population, and a large scenic area. Hypothesis H2-2 is verified. From the inflection point of the coefficient, tourists' destination choice before July 2020 was greatly affected by the novel coronavirus epidemic, while tourists' destination choice preferences gradually recovered from the original trend after July. During the period of COVID-19, tourists' destination preferences changed, and tourists were more inclined to open (large area) and relatively close scenic spots (low level of economic development and small regional population), which also contributes to the differentiation of the impact of COVID-19 on scenic spots.

In addition, there is usually a time lag between the outbreak of COVID-19 and the change in tourist volume in scenic spots, which reflects that there is a time lag between tourists receiving information related to COVID-19 and their final trip. The time lag increases with the increase in months, indicating that tourists generally feel sluggish and are less sensitive to the epidemic. In addition, in traditional tourist seasons such as holidays, tourists also produce retaliatory consumption psychology, such as the "May 1 holiday" and "October holiday", resulting in tourists' destination choice preferences in May and October being close to those without the impact of the epidemic, which also reflects that tourists' intrinsic motivation under the epidemic is easily changed. The delay in the impact of COVID-19 on tourist attractions and the relaxed vigilance of tourists during holidays all show that it is necessary to adopt prevention and control strategies in time when the epidemic occurs.

Conclusions

In the context of the normalization of epidemic prevention and control, it is necessary to correctly understand the relationship between tourism recovery and the epidemic situation, identify the changes in tourist activities, actively cope with the uncertainties brought by the epidemic, and provide help for the tourism industry to "turn crisis into opportunity". By using the kernel density method, the multiple time-delay nonlinear model, and other methods, this paper explores three characteristics of the impact of COVID-19 on scenic spots as a special tourism crisis event: differentiation, volatility, and time delay, and puts forward suggestions for the recovery and rejuvenation of different types of tourist spots. The main conclusions are as follows:

(1) The impact of COVID-19 on tourist attractions is different. In general, the recovery trend of tourist attractions is generally good, and the recovery speed is first fast and then slow. From the local point of view, the recovery of tourists in natural ecological scenic spots is first fast and then slow, and the recovery elasticity is good. The recovery speed of historical and cultural scenic spots and modern amusement scenic spots is slow first and then fast, and the recovery elasticity is poor. The individual difference in the restoration trend of natural ecological scenic spots is small, while the individual difference in the restoration trend of historical and cultural scenic spots and modern amusement scenic spots is large.

(2) The COVID-19 situation has a continuous fluctuating impact on tourist attractions, and the impact degree is in descending order of newly confirmed cases of the epidemic in China, public opinion about the epidemic, new imports from abroad, and newly confirmed cases from abroad. In terms of time, the epidemic situation at home and abroad significantly inhibited the tourist volume of scenic spots before June 2020, and the epidemic situation at home and abroad had no significant impact on the tourist volume of scenic spots after June 2020, while the number of new overseas imports and public opinion of the epidemic situation always had a negative impact on the tourist volume of scenic spots.

(3) The COVID-19 epidemic has a time lag effect on tourist attractions, reflecting the time from receiving the COVID-19 epidemic information to the occurrence

of tourism behavior. When the macro situation of the epidemic is more severe, the delay days of the impact are 0-1 days, and when the epidemic situation is better, the delay days of the impact are delayed to 3-4 days. At the same time, the time lag of tourists will also change during holidays and activities, indicating that tourists' sensitivity to the epidemic will gradually decrease with the advancement of the event.

(4) The differentiation, volatility, and lag of the impact of COVID-19 on tourist attractions are due to the impact of COVID-19 on tourists' travel motivation. During the epidemic, tourists are more inclined to open and be close to their own scenic spots, but they also pay attention to the distance between the COVID-19 outbreak, the location of the scenic spot, and their own location. Tourists will transform the public opinion environment into psychological distance. Given the background that the COVID-19 epidemic can be prevented and controlled, the following strategies are proposed to accelerate the recovery of scenic spots: 1) Different types of scenic spots adopt different recovery methods; natural ecological scenic spots should seize the recovery opportunity and speed up the recovery pace; historical and cultural scenic spots and modern recreational scenic spots should wait for the opportunity and make good use of holidays to drive recovery through marketing strategies; 2) We should pay attention to tourists' perceptions of crises, weaken the influence of public opinion on tourists' psychology, and reduce unnecessary pressure from public opinion; 3) In order to avoid the danger of hysteresis, it is necessary to respond quickly when the epidemic occurs and resolutely take measures to close the park to prevent the spread of the epidemic.

During the COVID-19 epidemic, the number of tourists in high-level scenic spots has been greatly disturbed by policy requirements, and the recovery trend of scenic spots is quite different from that under natural conditions. As policy factors are difficult to quantify, this paper does not fully reflect the impact of policies on the recovery of tourist volume in scenic spots under the influence of the epidemic, which also leads to the poor universality of this paper.

In terms of the selection of other explanatory variables, the area of natural ecological scenic spots is usually larger and that of historical and humanistic scenic spots is smaller. Therefore, this paper selected "area of scenic spots" as an explanatory variable to quantify the impact of COVID-19 on different types of scenic spots. In addition, there are many influencing variables only for the research element of "tourist volume in scenic spots". In order to maximize the study of the impact of the COVID-19 outbreak on the tourist volume of the scenic spot, this paper refers to relevant literature about the impact of COVID-19 on the economy, transportation, and residents' consumption, and includes factors such as regional economy and population into variables, but ignores some factors that cannot be quantified, such as the development trend of scenic spots and weather, etc. This study needs to be further strengthened in future work.

Conflict of Interest

The authors declare no conflict of interest.

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