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Original Paper

Analysis of Factors Influencing Tourism Revenue in Zhangjiajie City

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Abstract

Tourism income is influenced by many factors, such as the number of domestic tourists, inbound tourists, civil aviation passenger volume, highway mileage, GDP and per capita disposable income of urban residents. Based on the time series data from 2002 to 2020, this paper makes an empirical study on the influencing factors of tourism income in Zhangjiajie by using the methods of unit root test, co-integration analysis, elimination of multicollinearity and elimination of sequence correlation. the following conclusions can be drawn: (1) The number of inbound tourists and the gross domestic product do not have a significant impact on the increase in total tourism revenue in Zhangjiajie City. (2) Four aspects, including the number of domestic tourists, civil aviation passenger traffic, road mileage, and per capita disposable income of urban residents, have a significant impact on the increase in total tourism revenue in Zhangjiajie City. Specifically, on average, for every 1% increase in the number of domestic tourists, the total tourism revenue of Zhangjiajie City increases by an average of 0.515%. Similarly, for every 1% increase in civil aviation passenger volume, the total tourism revenue increases by an average of 0.349%. However, for every 1% increase in road mileage, the total tourism revenue decreases by an average of 0.475%. On the other hand, for every 1% increase in per capita disposable income of urban residents, the total tourism revenue increases by an average of 1.229%. (3) There is no lag effect on the increase or decrease in total tourism revenue. Based on the research findings, some policy suggestions are given.

Keywords: Zhangjiajie City, The tourism industry, Time series data, Cointegration analysis

1. Introduction

1.1 Research Background and Significance

The 19th National Congress report emphasizes that the social contradictions in our country have evolved into the contradiction between the continuous growth of people's demand for a better life and the imbalanced and insufficient development[1]. This profound reflection embodies the people-oriented concept of social development. After the reform and opening up, the country proposed to "vigorously develop the tourism industry", and the development of the tourism industry has undergone the stages of industrialization and marketization over the past 40 years[2]. At present, driven by the increase in per capita income and the wave of consumption, the continuously expanding tourism consumption market has gradually transformed the consumption purposes of the masses from survival-oriented to development-oriented and enjoyment-oriented. The era of mass tourism reflects the rigid demand of the people's continuous pursuit of a better life. The tourism industry has transformed from the traditional single pattern of sightseeing to a multi-industry pattern with economic benefits and cultural effects. The tourism industry is a labor-intensive industry that relies heavily on manual labor, especially physical labor. Its characteristics are large capacity and low entry barriers. Therefore, the development of the tourism industry is conducive to increasing employment opportunities for people at different levels. The numerous benefits generated by the tourism industry have made it a growth point in the development of our national economy. The tourism industry can play a radiating role, and through the extension of the tourism industry chain, the economic benefits generated can not only drive the upgrading and iteration of the industry itself, but also directly or indirectly promote the coordinated

development of related industries, thereby promoting comprehensive economic development in the entire region.

Zhangjiajie City, located in the northwest of Hunan Province, is a tourist-oriented city. It is situated in the hinterland of the Wuling Mountain area, along the upper reaches of the Lishui River. The region is rich in tourism resources, attracting tourists from all over the world with its beautiful natural scenery and profound cultural heritage. Zhangjiajie City serves as a platform for the Hunan Provincial Government to attract foreign enterprises to settle and develop in Hunan, and it has become the core city of the tourism economy in northwest Hunan. Over the past 40 years since its establishment, with the rapid development of the domestic tourism market, the tourism industry has become an important pillar industry of Zhangjiajie City, playing a leading role in various aspects of industry support, demonstration tourism, and exemplary leadership. In March 2018, the government work report "Guiding Opinions on Promoting the Development of Integrated Tourism" pointed out that in order to optimize the development environment of China's tourism industry, accelerate the rapid transformation and upgrading of the tourism industry, and promote quality improvement and efficiency enhancement, a new path of integrated tourism development should be taken[3]. According to data from the China Tourism Academy in 2020, Zhangjiajie City's tourism revenue reached 90.56 billion yuan in 2019, a year-on-year increase of 23.6%. The city received a total of 80.493 million domestic and foreign tourists throughout the year, of which 79.123 million were domestic tourists, a year-on-year increase of 15.2%. The number of inbound tourists was 1.37 million, a year-on-year increase of 178.7%. On April 23, 2021, Zhangjiajie held a promotion and discussion meeting titled "Enchanting the World with the Fairyland Zhangjiajie," introducing 10 high-quality tourist routes and 3 red-themed special products[4], among other innovations, in order to continue maintaining the rapid growth trend of tourism economic income exceeding GDP growth rate.

However, in recent years, with the rapid development of the social economy and the need to accelerate the transformation and upgrading of the tourism industry, the problems in the economic development of Zhangjiajie City have become increasingly prominent: firstly, the economic development of Zhangjiajie City is relatively slow, with outdated supporting infrastructure, insufficient urban vitality, and low level of urbanization. Therefore, it is increasingly important to upgrade industries, make full use of existing resources, especially to maximize the economic benefits of tourism resources in the economic development of Zhangjiajie City, consolidate and expand the city's position in the domestic and international tourism market, and ensure sustainable development of the industry. In this regard, this article aims to clarify the market positioning of the city and the feasibility analysis of the target market by studying the factors that affect the tourism revenue of Zhangjiajie City. This not only accumulates wealth for the national economy, but also provides an effective source of supply and demand for economic and social development. It is an effective way to stabilize the market and has a driving effect on the national economy.

1.2 Research Status Review in Domestic and International Fields

1.2.1 International Research Status

For the tourism industry, the tourism sector is a product of social and economic development at a certain stage, and the analysis of national conditions should start from the structure of the tourism industry and the factors influencing the development of the tourism industry. As early as the 1860s, many foreign scholars keenly realized the importance of the tourism industry for the development of a country and began empirical research on the factors influencing the development of the tourism industry. The French mathematician Adrien-Marie Legendre first published the method of least squares in 1805, which was applied to various fields due to its simple and convenient calculation methods[5]. Foreign scholars such as Fitchett Jennifer conducted a large number of empirical studies on the factors influencing the tourism industry, such as the climate of the destination[6] and the local environment[7], which are also factors affecting the development of the tourism industry[8]. In 2004, Drisaks used quantitative analysis methods to study the mechanism of the impact of the Greek tourism industry on economic growth and found that the Greek tourism industry played a promoting role in economic growth[9].

1.2.2 Current Research Situation in China

The research on tourism in China started relatively late, and it began to develop slowly along with the pace of China's reform and opening up. With the implementation of the reform and opening up policy, the academic community, education sector, and relevant government departments in China have paid increasing attention to the research on tourism economy. In 2013, Ma Xuefeng conducted a study on the development of tourism industry and economic growth in Zhangjiajie City using a combination of qualitative research and quantitative analysis, and found that the tourism industry has a stimulating effect on other industries[10]. In 2014, Luo Yao conducted research and found that the feedback effect of the transportation industry on the tourism industry is influenced by regional differences, as there are differences in endowment and development speed between the transportation industry and the tourism industry[11]. Wang Zhaofeng used the Super-SBM model and grey relational analysis to analyze the indicators that affect the comprehensive efficiency of Zhangjiajie, and the results showed that the average comprehensive efficiency of Zhangjiajie is relatively low[12].

1.3 Research Methods and Research Content

1.3.1 Research Methods

1. Inductive and summary analysis method: By reading and categorizing authoritative literature on the factors influencing the tourism industry by domestic and foreign scholars, the research status of this issue is summarized to provide a solid theoretical basis for this study.

2. Empirical analysis method: For the selected model, we can analyze relevant data using mathematical and statistical methods, establish a regression relationship function between the dependent variable and independent variables, and apply methods such as least squares, D.W. test, and E-G two-step method to study the important indicators of factors affecting tourism revenue in Zhangjiajie City.

3. Comprehensive analysis method: Conduct a comprehensive analysis of the obtained optimal model and attempt to propose specific ways for further development of the tourism industry in Zhangjiajie City.

1.3.2 Research Content

Part 1: This part mainly introduces the research background, significance, and the current status of tourism research in Zhangjiajie City, both domestically and internationally. It also provides a brief overview and organizational structure of this article, laying a solid foundation for further research on the factors influencing tourism.

Part 2: This part primarily analyzes the impact of tourism development in Zhangjiajie City on economic growth. It focuses on the development process and current situation of the tourism industry, the economic development situation, and the existing problems in the tourism economy of Zhangjiajie City.

Part 3: Using annual data from 2002 to 2020 as the basis, this part conducts an analysis of the relevant indicators of tourism in Zhangjiajie City using Eviews10 software. Firstly, the stationarity of the time series data is tested. Secondly, cointegration tests are conducted on the same-order integrated sequences, followed by an analysis of sequence correlation and tests for eliminating autocorrelation and multicollinearity. Finally, the optimal linear regression model for the two variables that significantly affect tourism revenue in Zhangjiajie City is obtained through stepwise regression, and the empirical results are analyzed.

Part 4: This part proposes policy recommendations to promote tourism revenue in Zhangjiajie City, including expanding the coverage of tourism promotion, increasing attractiveness to domestic tourists, and actively attracting investment to promote sustained and rapid GDP growth.

2. Analysis of the Current Development Status of the Tourism Industry in Zhangjiajie City

2.1 Current Situation of Tourism Industry Development in Zhangjiajie City

Zhangjiajie City, formerly known as "Dayong City," is located in the northwest of Hunan Province, China. It is mainly characterized by mountainous terrain. It was established as a prefecture-level city in

1988 with the approval of the State Council. The city has a rich folk culture, beautiful natural scenery, and abundant biodiversity. It is the central area proposed by the State Council to construct the "Wuling Mountain Economic Cooperation Zone" and is a renowned tourism-driven city in China. Zhangjiajie City has abundant tourism resources, including lakes, caves, hot springs, and more. It is home to the first national forest park in China, Zhangjiajie National Forest Park, and the rare quartz sandstone peak forest and canyon landforms. The three major scenic areas of Zhangjiajie National Forest Park, Tianzi Mountain Nature Reserve, and Suoxi Valley Nature Reserve constitute the Wulingyuan Scenic Area as shown in Table 1. As a key domestic tourist city, Zhangjiajie City's tourism development is gradually improving. Under the leadership of the local government, high-quality transformation work is being steadily completed. Zhangjiajie always keeps an eye on the world, grasps various policies actively, and utilizes its advantageous geographical location, huge market potential, and red culture to promote the development of tourism industry with scale, characteristics, and branding as the core. It aims to promote the deep expansion of the tourism industry chain and achieve sustainable economic growth, solidifying the high-quality development of tourism.

Table 1. Overview of Tourism Resources in Zhangjiajie City

Category	**Name**	**Location**
National-level nature reserves	Zhangjiajie Dafu Natural Reserve in Hunan Province	WulingyuanDistrict
	Hunan Gongshan Nature Reserve	Sangzhi County
World Cultural and Natural Heritage	Wulingyuan Scenic and Historic Interest Area	WulingyuanDistrict
National Forest Park	Zhangjiajie National Forest Park in HunanHunan Tianmen Mountain National Forest Park	Wulingyuan District Yongding District
Geological Wonder National Park	Zhangjiajie Sandstone Peak Forest National Geopark in Hunan	Zhangjiajie City

Since the reform and opening up, the tourism economy in Zhangjiajie City has developed rapidly, becoming a new growth point of the national economy and a driving force for the overall economy. This article presents the data on total tourism revenue in Zhangjiajie City from a statistical analysis perspective to describe the current situation of relevant variables and lay the foundation for subsequent empirical analysis. Total tourism revenue reflects the overall operating scale and achievements of a tourist destination country or region. According to incomplete data statistics, tourism consumption has been the fastest-growing sector in household consumption. From 2002 to 2019, the total tourism revenue of Zhangjiajie City showed an increasing trend, as shown in Figure 1. By the end of 2019, the total tourism revenue in Zhangjiajie City was 90.56 billion yuan, which was 27.6 times the total tourism revenue of 3.28 billion yuan in 2002. Especially after 2008, the growth rate has gradually increased, indicating a continuous upward trend in tourism demand.

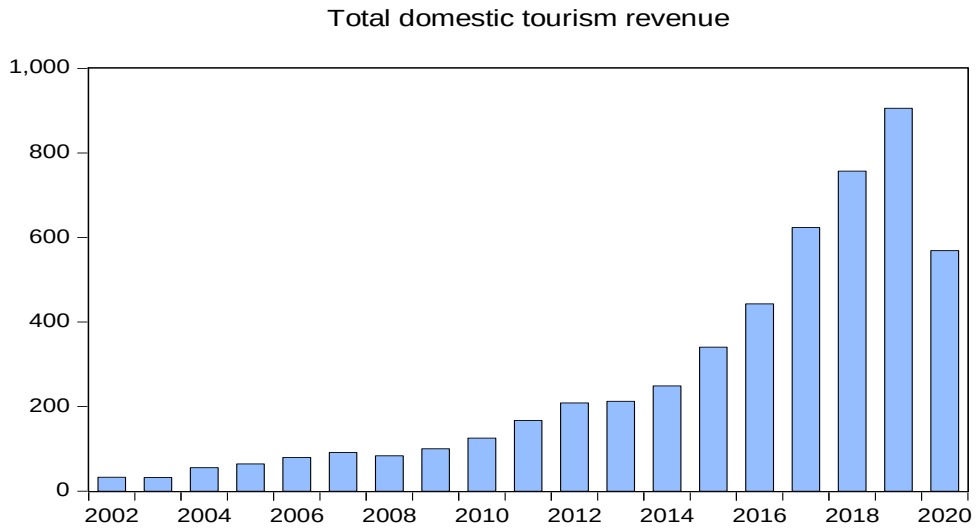

Figure 1. Total domestic tourism revenue in Zhangjiajie City from 2002 to 2020 (Unit: 100 million yuan)

The number of domestic tourists in 2019 was 79.123 million, which is 38.5 times the number of domestic tourists in 2002, which was 7.2466 million. The year-on-year growth rate in 2019 was 15.2%. The number of inbound tourists in 2019 was 1.37 million, which is 4.4 times the number of inbound tourists in 2002, which was 0.3098 million. The year-on-year growth rate in 2019 was 178.7%. Both the number of domestic tourists and inbound tourists decreased in 2020 due to the COVID-19 pandemic, as shown in Figure 2.

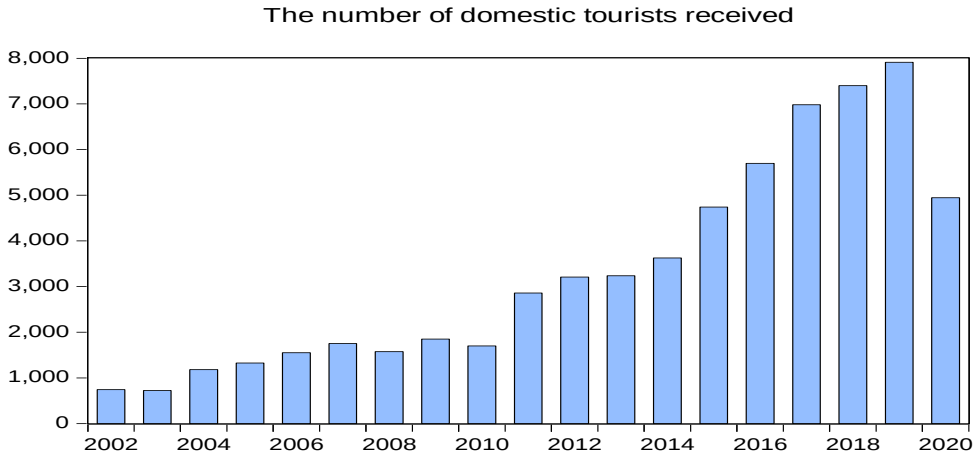

Figure 2. The number of domestic tourists received in Zhangjiajie City from 2002 to 2020 (Unit: Ten thousand people)

2.2 Problems in the Tourism Economy of Zhangjiajie City

Behind the steady growth of tourism revenue in Zhangjiajie City, there is a problem of excessive commercialization of tourist attractions. This commercialization phenomenon is mainly reflected in the following aspects.

Firstly, in terms of the regional and customer sources of tourism, domestic tourism is mainly concentrated in economically developed coastal cities such as Beijing, Shanghai, and Guangdong,

where well-developed tourist facilities attract a large number of tourists. In comparison, Zhangjiajie City and other places are less accessible and relatively cold, so tourists are more inclined to choose the former as their destination. This has led to insufficient development of tourism resources in Zhangjiajie City and other places, mostly limited to basic development outside of tourism resources.

Secondly, in terms of consumption structure, the majority of tourism consumption belongs to sightseeing consumption, while cultural and experiential consumption is relatively scarce. Tourists tend to take a superficial approach to tourism, with less consumption in terms of self-improvement and understanding local customs. This biased consumption structure leads to a lack of cultural connotation provided by tourist attractions.

Thirdly, in terms of tourism service products, there is a lack of cultural connotation and serious homogenization of products. Most tourism products are repetitive and lack uniqueness and individuality. Local specialty products lack cultural and commercial value, which fails to attract the interest of investors and leads to a shortage of development funds. At the same time, insufficient cultural development of tourism projects also limits the attractiveness and competitiveness of tourist attractions.

3. Theoretical Model of Factors Influencing Tourism Revenue in Zhangjiajie City

3.1 Data Selection and Preprocessing

3.1.1 Data Selection

With the development of social economy, the importance of the tourism industry as a new growth point of the national economy has become increasingly prominent[13]. Combining with the current development status of the tourism industry, Zhangjiajie City's tourism economy is influenced by many factors. Among these factors are not only macro factors such as regional economic development level and industrial development policies, but also factors such as people's living standards, consumer preferences, consumer expectations for tourism expenditure, and "Golden Week" holidays that affect tourism revenue. Therefore, in order to make the analysis credible, this paper combines the actual situation of Zhangjiajie City's tourism operation and the availability of statistical data, and selects the data from 2002 to 2020 as the sample period (annual data) as shown in Table 2.

Table 2. Data on the Impact of Tourism Revenue in Zhangjiajie City from 2002 to 2020

Year	Tourism Total revenue / 100 million yuan	Number of domestic tourists /in ten thousand person-times	Number of domestic tourists /in ten thousand person-times	Civil aviation passenger traffic volume /10,000 person-times	Highway passage Car mileage /kilometers	Gross Domestic Product (GDP) in China / RMB (in billions)	Urban residents Per capita disposable income /in yuan
2002	32.8	742.66	30.98	71.3	4052	121717.4	7703
2003	32.01	723.85	35.73	66.9	4059	137422	8472
2004	55.21	1179	90	131.81	4350	161840.2	9422
2005	64.35	1324.21	128.79	155.43	4467	187318.9	10493
2006	79.38	1549	127	151.26	6497	219428.5	11759
2007	91.25	1752.1	125.9	151.67	6516	270092.3	13786
2008	83.49	1573.28	105.85	102	6558	319244.6	15781
2009	100.2	1847.74	80.68	120.25	6743	348517.7	17175
2010	125.32	1698.91	705.91	113	8502.54	412119.3	19109

2011	167.31	2859	182	115	8658.52	487940.2	21810
2012	208.72	3210.2	379.9	113.52	8668.1	538580	24565
2013	212.3	3235.83	206.58	100.63	8773.91	592963.2	26955
2014	248.7	3624.83	259.75	109.16	8773.91	643563.1	28844
2015	340.7	4740.89	334.2	140.6	8756.77	688858.2	31195
2016	443.1	5696	447	170.2	8812	746395.1	33616
2017	623.78	6979.92	355.89	177.37	8998	832035.9	36396
2018	756.8	7397.4	562.15	220.99	9014	919281.1	39251
2019	905.6	7912.3	154.9	287.1	9057.4	990865.1	42359
2020	569	4945.2	151.70	127.84	9206	1013567.0	43834

Note. The original data is sourced from official government websites such as the "2002-2019 Zhangjiajie City National Economic and Social Development Bulletin," "2021 Zhangjiajie Statistical Yearbook," and "China Tourism Statistical Yearbook."

3.1.2 Data Preprocessing

Based on the data obtained from the Statistical Yearbook of Zhangjiajie City for the years 2002-2020, this study selects six relevant indicators to establish a time series data and econometric model related to tourism revenue. The effects of these influencing factors can be positive or negative, and some factors may even be found to have no significant impact after testing. Based on the analysis above, the following hypothesis is proposed: these influencing factors have a positive effect on the expected tourism revenue, as shown in Table 3.

Table 3. Relevant Variables Affecting the Tourism Economy Development in Zhangjiajie City

Variable name	**Unit of measurement**	**Variable symbol**	**Expected income impact**
Total tourism revenue	100 million yuan	Y	
Number of domestic tourists	Ten thousand people	X1	+
Number of inbound tourists	10,000 person-times	X2	+
Civil aviation passenger volume	Ten thousand people	X3	+
Road mileage	kilometer	X4	+
Gross Domestic Product (GDP)	One hundred million yuan	X5	+
Per capita disposable income of urban residents	Yuan	X6	+
Other influencing factors (residual terms)	/	ε	+

Note. "+" indicates that as the variable index value increases, domestic tourism revenue will increase; "-" indicates that as the variable index increases, domestic tourism revenue shows a downward trend. This conclusion is based on the original data collected from the "China Tourism Statistical Yearbook" from 2002 to 2019, the "2002-2019 Zhangjiajie City National Economic and Social Development Statistical Bulletin," and the "2021 Zhangjiajie Statistical Yearbook."

3.2 Explanation of Relevant Indicators

3.2.1 Dependent Variable

The total tourism revenue of Zhangjiajie City (Y) is the dependent variable, which represents the income obtained from domestic tourism sales, including tourism products. It is a part of the redistribution of national income and directly reflects the tourism economic situation.

3.2.2 Explanation of Variables

(1) The primary factors influencing total tourism revenue are the number of domestic tourists (X1) and the number of tourists entering the country (X2). The number of tourists is an important indicator for evaluating the level of tourism industry development in a country or region[14].

(2) The variables for transportation facilities can include civil aviation and road network mileage. This study selected civil aviation passenger volume (X3) and road mileage (X4) as indicators to measure the level of regional transportation industry development.

(3) The variables selected to represent the tourism per capita expenditure in the macroeconomic environment are the Gross Domestic Product (GDP) and the per capita disposable income of urban residents. The GDP total for each year from 2002 to 2020 is chosen to represent the annual domestic production value.

3.2.3 Random Error Term

The random error term, also known as the residual term[15], reflects the impact of various small errors other than the independent variables on the dependent variable in the regression equation. It cannot be directly observed and is inevitable.

4. Model Construction and Optimization

4.1 Statistical Description

In order to avoid heteroscedasticity and make the data more stationary and comparable, the data of each variable was transformed using logarithm, forming new time series lnY, etc. The statistical descriptions of these new time series are shown in Table 4.

Table 4. Descriptive Statistics of the Data

Variables	Mean	Median	Maximum value	minimum value	Standard deviation	Sample size
lnY	5.056442	4.975359	6.808598	3.466048	1.023012	19
lnX1	7.819300	7.739973	8.976174	6.584584	0.756143	19
lnX2	5.151889	5.061994	6.559488	3.433342	0.876945	19
lnX3	4.871142	4.835467	5.659831	4.203199	0.358042	19
lnX4	8.854936	9.05721	9.111337	8.306966	0.30366	19
lnX5	12.88567	13.01351	13.80633	11.70946	0.676449	19
lnX6	9.869892	9.924019	10.65394	8.949365	0.554595	19

4.2 Line Graph of lnY and Explanatory Variable

Currently, every industry is enjoying the benefits of economic growth, and the tourism industry is no exception. In order to illustrate the relationship between relevant variables and the changes in total tourism revenue, the line graphs of the relevant data from 2002 to 2020 are integrated together, as shown in Figure 3.

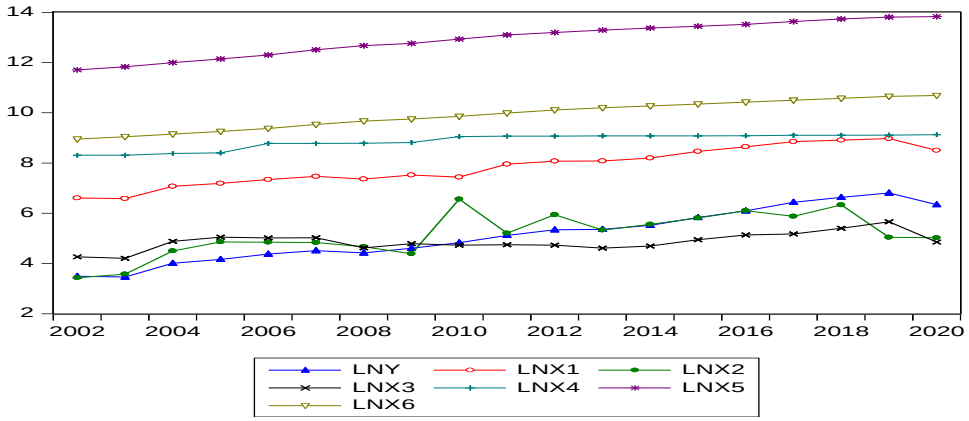

Figure 3. Line graph of lnY and explanatory variable

As shown in Figure 3, there is a positive relationship between the growth of Gross Domestic Product (GDP) and the development of the tourism industry in China, indicating a mutual promotion between them. From the trend of GDP growth, the trend of per capita disposable income of urban residents is similar to that of GDP, suggesting a high correlation between the two. When GDP increases, it implies an improvement in people's income levels, which attracts more foreign investment and tourists to China, thereby driving the development of the domestic tourism industry and increasing the total tourism revenue. With the increase in per capita disposable income of urban residents, the number of domestic tourists also rises. The trend of increasing domestic tourist numbers is similar to the trend of income growth, indicating a certain correlation between the two. The growth in tourist numbers leads to an increase in civil aviation passenger traffic and road mileage. However, looking at the curve of civil aviation passenger traffic, although the number of passengers has been increasing between 2002 and 2019, the growth rate is not significant. At the same time, the growth in tourist numbers contributes to the increase in total tourism revenue, indicating a strong correlation between the two.

4.3 ADF Unit Root Test

Non-stationary time series have a common trend of co-movement, while stationary series do not exhibit "spurious regression" and have objective and accurate economic relationships. To avoid the phenomenon of "spurious regression," it is necessary to conduct unit root tests on the logarithmic variables before analysis, in order to select stationary variables for regression [16]. In the test for stationarity, the use of statistical tests is crucial as it provides accurate results. Table 5 presents the results obtained from the ADF test.

Table 5. ADF Test Results for Variables

Testing variables	**Type verification (C,T,K)**	**ADF statistic**	**Critical values of ADF at a significant level**			**D.W value**	**P-value**	**Test results**
			1%	**5%**	**10%**			
Y	(0,0,3)	0.558014	-2.72825	-1.96627	-1.60503	1.9411	0.8250	unstable
lnY	(C,T,2)	-3.20040	-4.66788	-3.73320	-3.31035	1.8440	0.1191	unstable
ΔlnY	(C,0,0)	-3.01975	-3.88675	-3.05217	-2.66659	1.0808	0.0531	Stable&
X1	(0,0,0)	0.278160	-2.69977	-1.96141	-1.60661	1.1388	0.7553	unstable
lnX1	(0,0,0)	1.869464	-2.69977	-1.96141	-1.60661	1.7902	0.9807	unstable
ΔlnX1	(0,0,0)	-2.87680	-2.70809	-1.96281	-1.60613	1.5795	0.0068	stable*

X2	(C,0,0)	-3.49592	-3.85739	-3.04039	-2.66055	2.1635	0.0207	stable#
lnX2	(C,0,0)	-2.86230	-3.85739	-3.04039	-2.66055	2.5892	0.0696	stable&
ΔlnX2	(0,0,0)	-6.82400	-2.70809	-1.96281	-1.60613	1.8205	0.0000	stable*
X3	(C,0,0)	-2.42355	-3.85739	-3.04039	-2.66055	1.7182	0.1495	unstable
lnX3	(C,0,0)	-2.47856	-3.85739	-3.04039	-2.66055	1.7385	0.1366	unstable
ΔlnX3	(0,0,0)	-3.37238	-2.70809	-1.96281	-1.60613	1.2774	0.0022	stable*
X4	(C,0,3)	-4.83415	-3.95915	-3.08100	-2.68133	1.1897	0.0020	stable*
ΔlnX4	(0,0,3)	-3.61522	-2.74061	-1.96843	-1.60439	1.6220	0.0015	stable*
X5	(C,0,2)	1.090045-3	-3.92035	-3.06559	-2.67346	1.6617	0.9953	unstable
lnX5	(C,0,2)	.16325	-3.92035	-3.06559	-2.67346	1.7017	0.0418	stable#
ΔlnX5	(C,T,1)	-3.55318	-4.66788	-3.73320	-3.31035	1.7378	0.0675	stable&
X6	(C,T,0)	-3.09084	-4.57156	-3.69081	-3.28691	1.7208	0.1376	unstable
lnX6	(C,0,0)	-3.43765	-3.85739	-3.04039	-2.66055	1.1271	0.0232	stable#
ΔlnX6	(C,T,1)	-3.37066	-4.66788	-3.73320	-3.31035	1.7725	0.0909	stable&

Note. (C, T, K) represents the constant term, trend term, and lag order used in the test; P-value represents the probability of accepting the null hypothesis. Δ represents first-order difference. *, #, & represent the ADF critical values at the 1%, 5%, and 10% confidence levels.

From Table 5, it can be seen that at a significance level of 5%, only X4 in the original series is stationary, while the other original series are non-stationary. In the logarithmic series, at a significance level of 5%, lnX4, lnX5, and lnX6 are stationary. In the first-order differenced logarithmic series, at a significance level of 5%, ΔlnX1, ΔlnX2, ΔlnX3, and ΔlnX4 are all stationary, while ΔlnX5 and ΔlnX6 are non-stationary. However, at a significance level of 10%, ΔlnY, ΔlnX5, and ΔlnX5 are all stationary. Therefore, at a significance level of 10%, all variables are first-order integrated series, satisfying the conditions for cointegration modeling.

4.4 Model Construction

Using the ADF test, on the basis of stationary series, the model for tourism revenue is set with the first-order stationary series lnY as the dependent variable and lnX1, lnX2, lnX3, lnX4, lnX5, and lnX6 as the explanatory variables, all of which are also first-order stationary.

$$lnY=\beta_0+\beta_1 lnX1+\beta_2 lnX2+\beta_3 lnX3+\beta_4 lnX4+\beta_5 lnX5+\beta_6 lnX6+\varepsilon_t \quad (1)$$

Where β_0-β_6 are the parameters to be estimated, and ε_t is the random error term.

4.4 Cointegration Test

To test for long-term equilibrium between multiple variables of the same order, cointegration tests are conducted on time series data. The sample data is annual. Assuming the cointegration test is satisfied, the Engle-Granger two-step method is used to conduct separate tests on the regression coefficients and residuals.

(1) For the same-order single integrated sequence regression. From Table 5, it can be seen that the sequences ΔlnY, ΔlnX1, ΔlnX2, ΔlnX3, ΔlnX4, ΔlnX5, and ΔlnX6 are all first-order single integrated sequences. Based on the time series data from 2002 to 2020, the cointegration equation (2) is estimated using the least squares method, and the residual sequence is generated.

$$lnY=-9.123+0.388lnX1+0.033lnX2+0.449lnX3+0.074lnX4-2.400lnX5-3.957lnX6 \quad (2)$$

T= (-6.76) (2.18) (0.80) (3.78) (0.21) (-2.16) (3.11)

R^2= 0.995888, F= 484.4221, D.W = 1.292052, N=19.

(2) A stationary test is conducted on the residual sequence et.

Based on the cointegration equation (2), assuming e_t=resid, an ADF test is performed on e_t, and the test results are shown in Table 6.

Table 6. The results of the ADF unit root test for the residuals e_t

Testing variables	Type verification (A,T,N)	ADF statistic	Critical values of ADF at a significant level			DW value	P-value	Test results
			1%	5%	10%			
e_t	(0,0,0)	-3.174395	-2.699769	-1.961409	-1.606610	1.931890	0.0033	stable*

Note. (C, T, N) represents the constant term, trend term, and lag order used in the test; P-value represents the probability of accepting the null hypothesis. "*" represent the ADF critical values at the 1% confidence levels.

According to Table 6, at a significance level of 0.01, P=0.0033, which indicates that the residual sequence is stationary. This also suggests that there is a cointegration relationship between lnY and lnX1, lnX2, lnX3, lnX4, lnX5, and lnX6. Furthermore, the cointegration equation fits well, indicating a long-term stable equilibrium relationship between the total tourism revenue in Zhangjiajie City and the explanatory variables.

4.5 Multicollinearity Testing and Correction

4.5.1 Multicollinearity Test

Multicollinearity refers to the high correlation between explanatory variables in a linear regression model, which leads to inaccurate estimation results[17]. To determine the presence of multicollinearity, a multicollinearity test is required. The correlation coefficient table among the explanatory variables is generated using EViews10, as shown in Table 7.

Table 7. The correlation coefficients between variables

Variables	**lnX1**	**lnX2**	**lnX3**	**lnX4**	**lnX5**	**lnX6**
lnX1	1.00000					
lnX2	0.73193	1.00000				
lnX3	0.73651	0.49603	1.00000			
lnX4	0.86996	0.82151	0.49571	1.00000		
lnX5	0.96967	0.78032	0.61614	0.94456	1.00000	
lnX6	0.97550	0.76597	0.61985	0.93003	0.99865	1.00000

According to the correlation coefficient table in Table 7, the correlation coefficients between lnX1 and lnX4, lnX5, and lnX6 are 0.86996, 0.96967, and 0.97550, respectively, all of which are above 0.8, indicating a positive correlation. lnX2 and lnX4 also have a high correlation coefficient of 0.82151. lnX4 has a high correlation with lnX5 and lnX6, with correlation coefficients of 0.94456 and 0.93003, respectively. lnX5 and lnX6 have a correlation coefficient of 0.99865, indicating a high correlation as well. All of these suggest the likely presence of multicollinearity among the explanatory variables.

At the same time, considering the cointegration equation (2), the T-statistics for lnX2 and lnX4 are 0.80

and 0.21, respectively, indicating that neither of them passes the significance test for the variables. Therefore, it can be concluded that there is multicollinearity among the explanatory variables.

4.5.2 Eliminating Multicollinearity Using Stepwise Regression

Step 1: Find the basic equation. Take lnY as the dependent variable and lnX1, lnX2, lnX3, lnX4, X5, and lnX6 as the independent variables, resulting in six simple regression equations as shown in Table 8. Then, select the equation with the highest R^2 value as the basic equation.

Table 8. Finding the basic equation results (with ln Y as the dependent variable)

Variables	**lnX1**	**lnX2**	**lnX3**	**lnX4**	**lnX5**	**lnX6**
R^2	0.983889	0.506992	0.505513	0.760590	0.946056	0.956384

Comparing the sizes of R^2 in Table 8, it is found that the R^2 corresponding to lnX1 is the largest. Therefore, the basic equation is lnY = f(lnX1), and the corresponding regression equation (3) is:

lnY＝-5.628676 + 1.368843lnX1 (3)

T= (-16.79374) (32.22114)

R^2= 0.983889, Adjusted R^2= 0.982942, N=19.

In the second step, an explanatory variable is added one by one based on the basic equation. By adding lnX2, lnX3, lnX4, X5, and lnX6 to the basic equation, the stepwise regression results are obtained, as shown in Table 9.

From Table 9, it can be observed that the Adjusted R^2 decreases when lnX2, lnX3, and lnX4 are added successively to the basic equation. Additionally, the corresponding T-statistics for these variables are much smaller than 2, indicating that they fail to pass the T-test at a significance level of 5%. Therefore, the explanatory variables lnX2, lnX3, and lnX4 cannot be retained in the equation.

When lnX5 is added to the basic equation, although it increases the Adjusted R^2, its corresponding T-statistic is slightly smaller than 2, indicating that it also fails to pass the T-test at a significance level of 5%. Therefore, it is temporarily removed from the equation.

Table 9. Regression Results with Introduction of New Variables (Dependent Variable: lnY)

Variable	**lnX1**	**lnX2**	**lnX3**	**lnX4**	**Lnx5**	**lnX6**	**Adjusted R^2**
lnX1, lnX2	1.375227	-0.007817					0.981898
	(21.7767)	(-0.14023)					
lnX1, lnX3	1.369792		-0.002857				0.981876
	(21.7969)		(-0.02105)				
lnX1, lnX4	1.350262			0.052868			0.981938
	(14.9192)			(0.23447)			0.985345
lnX1,lnX5	1.081874				0.322541		
	(7.08924)				(1.94634)		
lnX1,lnX6	1.008130					0.489832	0.986752
	(6.57748)					(2.42696)	

Based on the basic equation, adding lnX6 not only increases the Adjusted R^2 but also results in a T statistic that is much larger than 2. At a significance level of 5%, lnX6 passes the T-test, indicating that it can be retained in the equation.

After this stepwise regression, only lnX6 is retained in the equation, and the basic regression equation (3) becomes regression equation (4).

lnY= -7.650799+ 1.008130lnX1+ 0.489832lnX6 (4)

T= (-8.654798) (6.577480) (2.426962)

R^2= 0.988224, Adjusted R^2 = 0.986752, F=671.3681, DW= 0.854544, N=19.

Step 3: Adding an explanatory variable in regression equation (4).

Based on regression equation (4), we further add explanatory variables lnX2, lnX3, lnX4, and lnX5 in a stepwise manner, resulting in the stepwise regression results as shown in Table 10.

Table 10. Regression Results with Introduction of New Variables (Dependent Variable: lnY)

Variable	**lnX1**	**lnX2**	**lnX3**	**lnX4**	**lnX5**	**lnX6**	**Adjusted R^2**
lnX1, lnX6,	1.01743	-0.02459				0.50448	0.986099
lnX2.	(6.4351)	(-0.4984)				(2.4158)	
lnX1, lnX6,	0.59942		0.34204			0.89058	0.990061
lnX3.	(2.8567)		(2.5152)			(3.7652)	
lnX1, lnX6,	0.93455			-0.46154		0.81002	0.988692
lnX4.	(6.3738)			(-1.9349)		(3.2491)	
lnX1, lnX6,	0.96194				-1.32623	2.15489	0.988334
lnX5.	(6.5819)				(-1.7803)	(2.2582)	

According to Table 10, it can be seen that adding the explanatory variable lnX2 to the regression equation (4) not only decreases the Adjusted R^2, but also the T-statistic for lnX2 is less than 2, indicating that it cannot pass the T-test. Therefore, lnX2 cannot be retained in the equation. Similarly, adding the explanatory variable lnX4 to the regression equation (4) increases the Adjusted R^2, but the T-statistic for lnX4 is less than 2, indicating that it cannot pass the T-test. Therefore, lnX4 cannot be retained in the equation. Additionally, adding the explanatory variable lnX5 to the regression equation (4) also increases the Adjusted R^2, but the T-statistic for lnx5 is less than 2, indicating that it cannot pass the T-test. Therefore, lnX5 cannot be retained in the equation.

Only by adding the explanatory variable lnX3 to the regression equation (4), it can increase the Adjusted R^2 and all the explanatory variables' T-statistics are much greater than 2, passing the T-test at a significance level of 5%. Therefore, the explanatory variable lnX3 can be retained in the equation. Through stepwise regression, the regression equation (5) with three explanatory variables is obtained.

lnY= -10.07858 + 0.599424*lnX1+ 0.342040*lnX3+ 0.890579*lnX6 (5)

T = (-8.1803) (2.8567) (2.5152) (3.7652)

R^2= 0.991718, Adjusted R^2= 0.990061, F= 598.6868, DW= 0.700842, N=19.

In the fourth step, an additional explanatory variable is added to regression equation (5).

Based on regression equation (5), the explanatory variables lnX2, lnX4, and lnX5 are sequentially

added, resulting in the stepwise regression results as shown in Table 11.

Table 11. Regression Results with Introduction of New Variables (Dependent Variable: lnY)

Variable	**lnX1**	**lnX2**	**lnX3**	**lnX4**	**lnx5**	**lnX6**	**Adjusted R^2**
lnX1,lnX6,	0.595438	-0.038177	0.357458			0.931382	0.989937
lnX3, lnX2.	(2.8195)	(-0.9024)	(2.5922)			(3.8445)	
lnX1,lnX6,	0.515181		0.349098	-0.475548		1.228758	0.992560
lnx3, lnX4.	(2.7884)		(2.9662)	(-2.4571)		(4.9823)	
lnX1, lnX6,	0.419931		0.437193		-1.889207	3.373935	0.994363
lnX3, lnX5.	(2.5295)		(4.1281)		(-3.5279)	(4.6466)	

Adding the explanatory variable lnX2 to regression equation (5) not only decreases the Adjusted R^2, but also results in a T-statistic for lnX2 that is less than 2, indicating that it cannot be supported by the T-test. Therefore, lnX2 should not be retained in the equation.

On the other hand, adding the explanatory variable lnX4 to regression equation (5) increases the Adjusted R^2 and all the T-statistics for the corresponding explanatory variables are greater than 2, indicating that they can be supported by the T-test. Therefore, lnX4 should be retained in the equation.

Similarly, adding the explanatory variable lnX5 to regression equation (5) increases the Adjusted R^2 and all the T-statistics for the corresponding explanatory variables are greater than 2, indicating that they can be supported by the T-test. Therefore, lnX5 can also be retained in the equation.

From a statistical perspective, the regression equation lnY=f(lnX1,lnX3,lnX4,lnX6) satisfies the condition, and the regression equation lnY=f(lnX1,lnX3,lnX5,lnX6) also satisfies the condition. However, from an economic perspective, there exists a functional relationship between per capita income of urban residents and gross domestic product, indicating the presence of multicollinearity between the two variables. Therefore, the regression equation that simultaneously satisfies both statistical and economic significance can only be lnY=f(lnX1,lnX3,lnX4,lnX6). Also, the regression equation (6) is as follows:

lnY= -8.585771+ 0.515181*lnX1+ 0.349098*lnX3 -0.475548*lnX4+ 1.228758*lnX6 (6)

T = (-6.9976) (2.7884) (2.9662) (-2.4571) (4.9823)

R^2= 0.994213, Adjusted R^2= 0.992560, F= 601.3165, DW= 1.659949, N=19.

In regression equation (6), all explanatory variables have absolute values greater than 2 and have passed the significance test for variables. However, regardless of whether lnX2 or lnX5 is added to regression equation (6), the resulting new regression equation still exhibits multicollinearity. Therefore, the regression equation that eliminates multicollinearity is equation (6).

4.6 Autocorrelation Test for Sequences

The Lagrange Multiplier (LM) test was used to test the serial correlation of the residuals for regression equation (6). The test results are shown in Table 12.

Table 12. The Lagrange Multiplier (LM) test results are as follows

Obs*R-squared	**LM value**	**Prob.Chi-Square(k)**	**P-value**
Obs*R-squared	0.121860	Prob.Chi-Square(1)	0.7270
Obs*R-squared	0.239460	Prob.Chi-Square(2)	0.8872
Obs*R-squared	1.939316	Prob.Chi-Square(3)	0.5851
Obs*R-squared	2.687703	Prob.Chi-Square(4)	0.6114
Obs*R-squared	4.971701	Prob.Chi-Square(5)	0.4193
Obs*R-squared	6.135581	Prob.Chi-Square(6)	0.4082
Obs*R-squared	6.136602	Prob.Chi-Square(7)	0.5239
Obs*R-squared	6.744704	Prob.Chi-Square(8)	0.5644
Obs*R-squared	9.506563	Prob.Chi-Square(9)	0.3919
Obs*R-squared	9.668971	Prob.Chi-Square(10)	0.4700

Note. k is the lag order.

From Table 12, it can be observed that for a significance level of 5%, the p-values corresponding to lag orders from first to tenth are all greater than 0.05. Therefore, from lag order one to lag order ten, the series is independent. In other words, the residuals of regression equation (6) are independent. Hence, regression equation (6) is the optimal equation.

5. Conclusion and Policy Recommendations

5.1 Main Conclusions

According to the optimal equation (6), the following conclusions can be drawn:

(1) The number of inbound tourists and the gross domestic product do not have a significant impact on the increase in total tourism revenue in Zhangjiajie City.

(2) Four aspects, including the number of domestic tourists, civil aviation passenger traffic, road mileage, and per capita disposable income of urban residents, have a significant impact on the increase in total tourism revenue in Zhangjiajie City. Specifically, on average, for every 1% increase in the number of domestic tourists, the total tourism revenue of Zhangjiajie City increases by an average of 0.515%. Similarly, for every 1% increase in civil aviation passenger volume, the total tourism revenue increases by an average of 0.349%. However, for every 1% increase in road mileage, the total tourism revenue decreases by an average of 0.475%. On the other hand, for every 1% increase in per capita disposable income of urban residents, the total tourism revenue increases by an average of 1.229%.

(3) There is no lag effect on the increase or decrease in total tourism revenue.

5.2 Policy Recommendations

With the rise in disposable income per capita among urban residents, there is a potential for faster growth in tourism revenue. To turn this possibility into actual growth in tourism revenue, there are several ways to promote the growth of domestic tourists.

Firstly, it is necessary to expand the reach of tourism promotion. The government can increase investment in tourism promotion and utilize modern network technology to strengthen the development of online information. This will allow for extensive promotion of the city's tourism image.

Secondly, through various professional training programs, practitioners can improve their cultural quality, professional competence, and service level. This will enhance the efficiency and quality of tourism consultation services, leading to increased consumer satisfaction.

Thirdly, it is important to provide advanced and convenient information services. By creating a unique tourism brand for the city and establishing a diverse and rational tourism consumption product and service system, the needs of domestic and foreign tourists can be met. This will also help to transform potential tourism consumer demands into actual consumption.

Additionally, increasing the volume of civil aviation passenger transportation is also crucial. Measures to achieve this include increasing flight frequency, expanding the fleet size, improving service quality, reducing ticket prices, opening new air routes, enhancing airport facilities and services, strengthening market promotion, and receiving government support. These measures can attract more passengers to choose air travel by increasing supply, boosting demand, and improving the overall passenger experience.

References

[1] Resolution on the Report of the 18th Central Committee of the Communist Party of China at the 19th National Congress of the Communist Party of China. *Contemporary Jiangxi*, *2017*(11), 29-31.

[2] Du Yili. Four main stages of development in China's tourism industry. *China Youth Daily*, 2018-08-02(008). DOI:10.38302/n.cnki.nzgqn.2018.005941.

[3] Guiding Opinions of the General Office of the State Council on Promoting the Development of Integrated Tourism. *China Culture Daily*, 2018-03-24(002). DOI:10.28144/n.cnki.ncwhb.2018.001525.

[4] "Zhangjiajie, a Fairyland that Astonishes the World" is the key tourist product route of Zhangjiajie City in 2021. *Zhangjiajie Municipal Bureau of Culture, Tourism, Radio and Television*, 2021-04-25 09:09:34.

[5] Tang, Xiaoming. *Experimental Tutorial on Econometrics*. Nanjing University Press, 201805.200.

[6] Fitchett Jennifer, Hoogendoorn Gijsbert. (2018). An analysis of factors affecting tourists' accounts of weather in South Africa. *International journal of biometeorology*, *62*(12).

[7] Juan Ignacio Pulido-Fernández, Pablo Juan Cárdenas-García, Juan Antonio Espinosa-Pulido. (2019). Does environmental sustainability contribute to tourism growth Ananalysis at the country level. *Journal of Cleaner Production*, *213*(3), 309-319.

[8] Wang Xinyue, Lu Xuejing, Zhu Wenliang. (2020). Analysis and Evaluation of Influencing Factors on the Development of Tourism Industry in China's Major Tourist Cities. *Economic Geography*, *40*(05), 198-209. DOI: 10.15957/j.cnki.jjdl.2020.05.022.

[9] Drisaks N. Tourism as a long run economic growth factor: An empirical investigation of Greece using a causality analysis. *Tourism Economics*, *2004*(10), 305-316.

[10] Ma Xuefeng. *Research on the Promotion of Regional Industrial Structure Evolution in Zhangjiajie Tourism Industry*. Shaanxi Normal University, 2013.

[11] Luo Yao. *A Study on the Regional Response of Zhangjiajie's Tourism Industry and Transportation Industry*. Jishou University, 2014.

[12] Wang Zhaofeng, Chen Qingqing. (2020). Evaluation of Tourism Efficiency and Influencing Factors in Zhangjiajie Based on Super-SBM Model. *Journal of Central South University of Forestry & Technology (Social Sciences)*, *14*(01), 71-76. DOI: 10.14067/j.cnki.1673-9272.2020.01.012.

[13] Wang Yongsheng. Current Situation and Future Demand Forecast of China's Tourism Industry Development. *Marine Development and Management*, *2004*(04), 58-60.

[14] Wu Xi. *Research on the Inbound Tourism Market of Hubei Province Based on Spatiotemporal Evolution*. Huazhong Normal University, 2013.

[15] Wang Miaomiao, Li Bofeng, Shen Yunzhong. (2016). Linear regression considering errors and correlation between independent and dependent variables. *Journal of Tongji University (Natural Science Edition)*, *44*(03), 446-453.

[16] Yuan Junnian. A Brief Introduction to the Cointegration Theory in Modern Econometrics. *International Business (Journal of University of International Business and Economics)*, *2000*(04), 7-11. DOI:10.13509/j.cnki.ib.2000.04.002.

[17] Wei Hongyan. (2019). Diagnosis and treatment of multicollinearity in regression analysis. *Journal of Zhoukou Normal University*, *36*(02), 11-15. DOI: 10.13450/j.cnki.jzknu.2019.02.003.