

ORIGINAL RESEARCH ARTICLE

Research on spatial difference and dynamic mechanism of virtual tourism flow based on online group purchase

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ABSTRACT

Taking the online group purchase of tourism products as the research perspective and the online group purchase virtual tourism flow of tourism products in 26 tourism destinations in China as the research data, this paper studies the spatial distribution differences and formation dynamic mechanism of virtual tourism flow through the method of spatial analysis. On the whole, the online group purchase virtual tourism flow shows weak discrete distribution characteristics, and some parts show certain aggregation. The virtual passenger flow is concentrated in the provinces with rich tourism resources in the south coast and central China, and the group purchase virtual tourism flow in the central and western regions, North China and Northeast China is small. The spatial distribution of group purchase virtual tourism flow is the result of the joint action of internal and external driving forces and environmental driving forces. The external driving forces include three main driving factors: product group purchase price, product type and network marketing spatial structure. Relevant analysis shows that group purchase price is the most important external driving factor, followed by product type and finally network marketing spatial structure. Taking group buying virtual tourism flow as the research perspective has a certain novelty, which makes up for the weakness of tourism flow in virtual space. The flow direction of virtual tourism flow can reflect the real tourism flow to a certain extent, and even guide the real tourism flow. The research of virtual tourism flow provides a predictive warning for the flow management and capacity management of scenic spots.

Keywords: online group purchase; virtual tourism flow; spatial differences; dynamic mechanism

1. Introduction

Network marketing has become one of the main channels of tourism product marketing because of its convenient and fast characteristics. How to innovate the network marketing mode of tourism products has always been the focus of tourism enterprises. Recently, the combination of the emerging online group

purchase mode represented by Groupon and tourism product marketing has become a new mode of online marketing of tourism products for tourism enterprises and tourist destinations. The non-standardization of tourism product pricing makes it possible for the super discount of group purchase of tourism products. The tourism products referred to in the study mainly refer to the scenic spot tickets with tourism resources as the main body and the tourism

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routes in series of many scenic spots. The pure catering group purchase, hotel group purchase and air transportation group purchase are not included in the tourism products.

As a new online marketing model, online group buying has attracted the attention of foreign scholars. They study the influencing factors of group buying behavior, evaluate group buying websites and study the perceived risk and trust of online group buying from the perspective of political economics or consumer behavior^[1-3]. The description of the phenomenon of group buying and the introduction of the new factors affecting the online consumption of group buying by domestic scholars^[4]. Some scholars also explain the new social phenomenon of online group buying from the perspective of game theory^[5]. In addition, some scholars have studied the online group purchase model from the perspective of political economics^[6]. Generally speaking, the research literature on online group buying is small in quantity and shallow in content, while the literature on tourism online group buying is less. Taking tourism products, network and group buying as the subject words, a total of 5 literatures from 2000 to 2011 were searched in the search scope of core journals. Wang L once made a tentative study on the online marketing of tourism group purchase, mainly focusing on the online marketing strategy of leisure tourism products and the research of tourism group purchase website^[7,8]; Shan evaluated the risk of group purchase of tourism products^[9]; Chen analyzed the new online marketing method of group purchase of tourism products^[10]. The search results show that the research literature on online group purchase of tourism products is less, and most of them are qualitative research. The research contents are relatively diverse, and the research focus is not prominent.

The study of tourism flow is a very important research content in tourism geography, and it is also a research hotspot at home and abroad. The research content involves the conceptual model of tourism flow^[11,12], the law of travel and entry^[13], the economic impact of tourism flow^[14], the spatial structure of tourism flow^[15], etc. At present, the research on

tourism flow is more in-depth and diverse, most of which focus on the research of real tourism flow, while less on the virtual tourism flow in cyberspace. With the development of the Internet and the strong momentum of online marketing, online shopping has become an important way for people to buy tourism products. Therefore, virtual tourism flow has become a barometer of real tourism flow, and virtual space has become an important way to obtain information. Therefore, taking online group buying as the starting point to study the spatial distribution difference of online group buying virtual tourism flow and analyze the dynamic mechanism causing this difference can greatly enrich the research content of virtual space tourism flow and online group buying of tourism products.

2. Data source

The data comes from three well-known group buying websites in China: Handle.com, glutinous rice and Wowo group. The data collection time is in September on the eve of the "National Day" golden week in 2011. When the "National Day" golden week is coming, tourism destinations and tourism enterprises will do their best to carry out online marketing of tourism group buying products. At this time, the collected data will make the research results richer and more reliable. Based on the group purchase data of tourism products in September, the scale and type of tourism group purchase products from 26 tourist destinations in China and the number of tourists purchasing products at each site are counted. The five provincial tourist destinations in Xinjiang, Tibet, Qinghai, Ningxia and Inner Mongolia did not provide tourists with any group purchase products on the handle, glutinous rice and Wowo groups. In addition, the data collection does not include Hong Kong, Macao and Taiwan.

Due to the different quantity of tourism products provided by different tourism destinations, the tourism flow of products purchased by different tourism destinations is quite different and cannot be compared. In order to facilitate comparison, the tourism flow uniformly uses the average tourism flow, that is,

the average virtual tourism flow is obtained by dividing the number of virtual tourists of all group purchase products by the number of products, in which the virtual tourism flow includes the number of people who pay attention to and the number of people who actually buy. The statistical results provide a guarantee for the research on the spatial difference and dynamic mechanism of online group purchase virtual tourism flow of tourism products.

3. Research methods

3.1. Global spatial autocorrelation

Spatial autocorrelation refers to the potential interdependence between the observed data of some variables in the same distribution area. Spatial autocorrelation is divided into global and local spatial autocorrelation. Global spatial autocorrelation reflects the overall trend of spatial correlation of observed variables in the whole study area, which is most measured by Moran's I index^[16].

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n W_{ij} (x_i - \bar{x}) (x_j - \bar{x})}{\sum_{i=1}^n \sum_{j=1}^n W_{ij} \sum_{i=1}^n (x_i - \bar{x})} = \frac{\sum_{i=1}^n \sum_{j=1}^n W_{ij} (x_i - \bar{x}) (x_j - \bar{x})}{s^2 \sum_{i=1}^n \sum_{j=1}^n W_{ij}} \quad (1)$$

Of which: $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$, $s^2 = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$

In the equation: I is Moran's I index; n is the number of spatial units, which is x_i, x_j in this study; \bar{x} is the attribute value s^2 of space unit 5; Mean and variance of attributes; W_{ij} is a spatial weight matrix, which is generally determined by the proximity standard and distance standard. This study adopts the proximity standard: if area i is adjacent to area j , its value is 1, $W_{ij} = 0$; otherwise, when $I = j$, $W_{ij} = 0$.

When Moran is used to analyze the spatial pattern of observation variables, significance test is re-

quired to ensure the correctness of inference conclusion under certain probability. If the data obey normal distribution, its statistical test can be tested by standardized statistic B ^[17,18].

$$Z = \frac{[I - E(I)]}{\sqrt{Var(I)}} \quad (2)$$

In the equation: $E(I)$ is the theoretical expectation, $E(I) = 1/(1 - n)$; $Var(I)$ is the theoretical variance. According to the size of Z value, the judgment of accepting or rejecting the null hypothesis is made under the set significance level, and the significance level is taken $\alpha = 0.05$, reject the null hypothesis when $Z < -1.96$ or $Z > 1.96$, and the spatial autocorrelation of the observed variables is significant, otherwise accept the null hypothesis.

3.2. Local spatial autocorrelation

The local spatial autocorrelation index can measure the local spatial correlation and spatial difference between each region and its surrounding areas. Local Moran, S statistic is generally used to measure the autocorrelation m of local space.

$$I_i = \frac{(x_i - \bar{x})}{s^2} \sum_{j=1, j \neq i}^n W_{ij} (x_j - \bar{x}) = X_i \sum_{j=1, j \neq i}^n W_{ij} X_j \quad (3)$$

In the equation: X_i, X_j is the i normalized value j of region and region attribute, $X_i = (x_i - \bar{x})/s$, $X_j = (x_j - \bar{x})/s$ and $\sum_{j=1, j \neq i}^n W_{ij} X_j$ is the spatial lag vector. Z test can be adopted for statistical testing.

4. Research results

4.1. Study on spatial differences of tourism flow

Global spatial autocorrelation

“Global spatial autocorrelation index Moran's value range is $[-1, 1]$ ^[18,19]. According to the calculation formula of global spatial autocorrelation, the global spatial autocorrelation index of virtual tourism flow in tourist destination is -0.0519 , and the absolute value of test value $Z(I)$ is 0.07 , less than 1.96 . Therefore, virtual tourism flow shows weak negative

spatial autocorrelation, that is, it shows weak discrete distribution characteristics. The results show that the overall flow direction of virtual tourism flow of group purchase of tourism products does not show the characteristics of agglomeration, but shows the characteristics of dispersion, which can be attributed to the fact that on the one hand. China is rich in tourism resources, and the heterogeneity of tourism resources makes the virtual tourism flow in different directions. On the other hand, the group purchase products always launch the most classic and cheapest tourism products in the region, making tourists buy their best and cheapest tourism products from different tourist destinations, even in places where resources are scarce, the introduction of classic products can also attract passenger flow. Therefore, the virtual tourism flow shows the characteristics of dispersion.

The comprehensive characteristics of the global virtual passenger flow distribution cannot indicate the passenger flow distribution state between each province and the surrounding neighboring provinces.

Therefore, it is necessary to analyze the partial distribution characteristics of tourist destination passenger flow with group purchase products in China in combination with the local spatial autocorrelation index.

Local spatial autocorrelation

The local spatial autocorrelation index of virtual tourism flow of 26 tourist destinations with tourism group purchase products is different (Table 1). Among them, the tourist destinations with obvious discrete state of virtual tourism flow are: Hunan, Jiangxi, Chongqing, Hubei, Shaanxi, Guizhou, Zhejiang and Tianjin. The tourist destinations with obvious agglomeration state of virtual tourism flow are: Shandong, Fujian, Hainan and Henan; The tourist destinations with discrete state of virtual tourism flow are: Beijing, Shanghai, Jiangsu and Yunnan; The tourist destinations where virtual tourism flows show agglomeration are Gansu, Heilongjiang, Hebei, Anhui, Liaoning, Sichuan, Jilin, Shanxi, Guangxi and Guangdong.

Table 1. Local spatial autocorrelation coefficient and Z-test of virtual passenger flow of online group purchase of tourism products in 26 tourist destinations

Variable	Gansu	Heilongjiang	Hunan	Hebei	Jiangxi	Chongqing	Anhui	Henan	Beijing	Shanghai	Liaoning	Sichuan	Jilin
I	0.21	0.11	-1.36	0.10	-1.35	-0.33	0.14	0.43	-0.20	-0.26	0.19	0.04	0.19
Z	-1.01	0.90	-7.72	0.82	-7.67	-1.70	1.03	2.74	-0.91	-1.26	1.35	0.44	1.34
Variable	Jiangsu	Shandong	Shanxi	Yunnan	Guangxi	Hubei	Fujian	Shaanxi	Guizhou	Hainan	Zhejiang	Tianjin	Guangdong
I	-0.01	0.28	0.08	-0.03	0.12	-0.43	0.59	-0.87	-1.20	2.03	-1.33	-1.03	0.03
Z	0.20	1.87	0.68	0.07	0.94	-2.30	3.69	-4.82	-6.78	12.04	-7.53	-5.76	0.41

Local spatial autocorrelation index combined with Moran scatter map or scatter map can visualize the spatial structure of local differences and study its spatial distribution law^[18,19]. The Moran scatter diagram (Figure 1) is drawn from the correlation between the standardized value $X_i = (x_i - \bar{x})/s$ and the spatial lag vector $W_x = \sum_{j=1, j \neq i}^n W_{ij}X_j$, based on which the spatial distribution difference of virtual tourism flow can be analyzed (Figure 2).

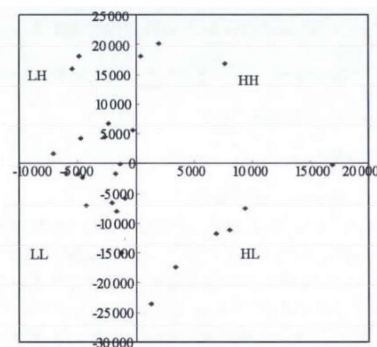


Figure 1. Local spatial autocorrelation Moran scatter diagram of virtual tourism flow.

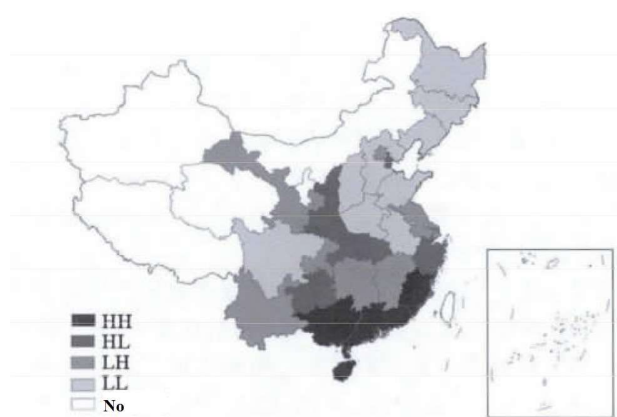


Figure 2. Spatial distribution difference of Virtual Tourism Flow.

Figure 1 shows that the number of tourist destinations in HH and HL is always less than that in LL and LH, indicating that, on the whole, the online virtual tourist flow is still concentrated in 34.62% of the provinces. The number of tourist destinations in HH and LL areas is equal to that in LH and HL areas, indicating that there are certain spatial differences in virtual tourism flows between tourist destinations, which have polarization characteristics. At the same time, virtual tourism flows between some tourist destinations have agglomeration characteristics. There are spatial differences in virtual tourism flows between tourist destinations, indicating that there are few cross regional products of online tourism group purchase products. The high passenger flow area does not bring high passenger flow in the surrounding area, and the high passenger flow area surrounded by the low passenger flow area is not affected by the low passenger flow. The passenger flow is only limited to this area and there is less cross regional flow.

Figure 2 reflects the spatial distribution characteristics of virtual tourism flow of group purchase of tourism products. HH area includes tourist destinations in Hainan, Fuzhou, Guangxi and Guangdong; LL area includes tourist destinations in Sichuan, Heilongjiang, Hebei, Anhui, Shanxi, Liaoning, Henan, Jilin and Shandong; HL area includes tourist destinations in Tianjin, Zhejiang, Guizhou, Shaanxi and Hubei; The LH area includes tourist destinations in Gansu, Chongqing, Beijing, Yunnan, Shanghai, Hunan, Jiangxi and Jiangsu.

The virtual passenger flow value of group purchase in HH regional tourist destination and the virtual passenger flow value of nearby tourist destinations are high, the spatial difference of passenger flow is small, and the passenger flow has the characteristics of agglomeration; The virtual passenger flow value of group purchase in LL regional tourist destination and the virtual passenger flow value of surrounding tourist destinations are low, the spatial difference of passenger flow is small, and the passenger flow in tourist destinations also has the characteristics of agglomeration, that is, the virtual passenger flow in tourist destinations is small. The spatial difference between the virtual passenger flow of tourist group purchase in HL area and that in other tourist destinations is large. This area is a relatively high value point of passenger flow, surrounded by the surrounding low value areas, with polarization characteristics. There is a large spatial difference between the virtual passenger flow of group purchase in the tourist destination of LH area and the virtual passenger flow in the surrounding area. This area is a relatively low value point of virtual passenger flow and is surrounded by the surrounding high-value areas. It can be seen that the online tourism group purchase products launched in Hainan, Guangxi, Guangdong and Fuzhou are more popular, and the virtual passenger flow value is higher; The online tourism group purchase products launched in Chengdu, Heilongjiang, Hebei, Anhui, Shanxi, Liaoning, Henan, Jilin and Shandong are not very popular, and the virtual passenger flow value is low; Tianjin, Zhejiang, Guizhou, Shaanxi and Hubei are more popular than the surrounding areas, and the virtual passenger flow value is higher than the surrounding tourist destinations; The online tourism group purchase products launched in Gansu, Chongqing, Beijing, Yunnan, Shanghai, Hunan, Jiangxi and Jiangsu are not very popular compared with the surrounding areas, and the virtual passenger flow value is low.

The analysis shows that the virtual passenger flow is concentrated in the southern coast (such as Hainan, Fuzhou, Guangxi, Guangdong, Zhejiang and Guizhou) and the provinces with rich tourism re-

sources in the central part (such as Shaanxi and Hubei), and the virtual passenger flow of group purchase is relatively small in the Central West, northeast and North China. During the National Day golden week, the passenger flow mainly flows to tourist destinations with mild climate, while the peak season of tourism in the northeast is mainly around December, so the passenger flow to these areas is less affected by the climate. Due to the influence of network economy, the western region has a weak momentum of network marketing and less passenger flow. Only some tourist destinations with rich tourism resources have large passenger flow.

4.2. Dynamic mechanism of spatial difference of virtual tourism flow

Push-pull theory is the basic theory of population flow, which can effectively explain the flow of tourists^[20]. Based on push-pull theory, this paper studies the spatial difference dynamic mechanism of online group purchase virtual tourism flow, and establishes the spatial difference dynamic mechanism model of online group purchase virtual tourism flow, so as to explain the spatial flow mechanism of virtual spatial tourism flow. The research shows that the spatial difference of virtual tourism flow is obvious. Only South China and Tianjin, Zhejiang, Guizhou, Shaanxi and Hubei have the largest virtual tourism flow, while the virtual tourism flow of other tourist destinations is low. The main driving forces of spatial difference include external environment, personal social characteristics and online group purchase marketing. The conceptual model of spatial difference driving force of tourism flow is shown in **Figure 3**, in which the external environment is the environmental driving force, personal social characteristics are the internal driving force, and online group purchase marketing is the external driving force. In view of the lack of data, this study analyzes the dynamic factors of external driving forces with the help of correlation analysis (**Table 2**), and other driving forces are only briefly described and left for subsequent empirical research.

Supporting elements: Environmental driving

force

The external environment includes network economy, group influence, seasonal climate and vacation system. The network economy is underdeveloped, and the network marketing is relatively weak. The lack of tourism flow is precisely due to the lack of tourism network group purchase product marketing and network construction. Group influence is also one of the influencing factors of tourists' group purchase. The network evaluation of group purchase products in the consumption process is also a factor affecting whether tourists buy the product. Seasonal climate makes tourism resources show seasonal advantages. The spatial difference of virtual tourism flow shows that South China is the gathering place of tourism flow, which is related to the "National Day" golden week is the peak tourism season in the south. The reason for the prosperity is also because of its obvious seasonal resource advantages. The holiday system is also one of the factors to ensure the flow of tourism. The long tourism holiday in the "National Day" golden week ensures the development of medium and long-term tourism activities. Therefore, the medium and long-term products launched in South China and other places are welcomed, leading to the movement of tourism to South China.

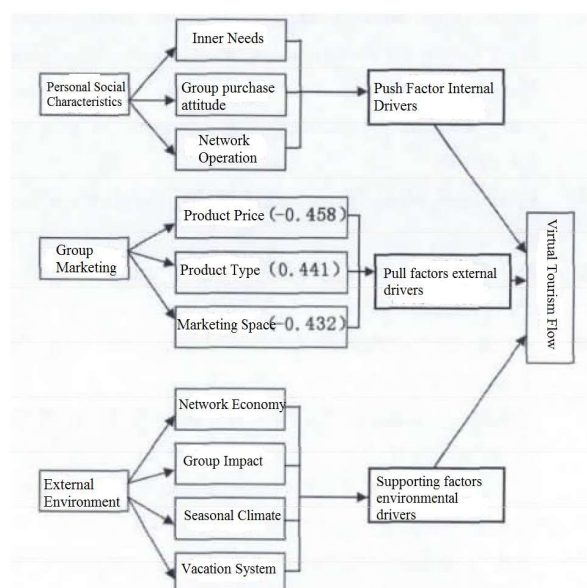


Figure 3. Conceptual model of spatial difference driving force of virtual tourism flow.

Table 2. Correlation test between external driving forces and virtual passenger flow

Factor	Correlation analysis	Virtual passenger flow
Discount	Pearson correlation	-0.458*
	Bilateral approximate <i>p</i> value	0.019
Internal difference of product passenger flow	Pearson correlation	0.441*
	Bilateral approximate <i>p</i> value	0.027
Marketing spatial structure	Pearson correlation	-0.432*
	Bilateral approximate <i>p</i> value	0.027

Note: * is the correlation with significance less than 0.05.

Push factor: Internal driving force

The survey shows that the basic reason for people's choice of products and personal use of the network is that people's internal demand for group buying and personal use of the network will have a greater impact on the characteristics of the individual, such as their age and occupation. Therefore, the survey shows that the main reason for people's choice of products and personal use of the network is that people have a greater demand for individual products. This is the internal thrust to promote online group buying.

Pull factor: External driving force. Online group purchase marketing mainly includes product type, product price and marketing space characteristics. It is not only the main pulling force for tourists to carry out online group purchase, but also the external driving force. The correlation test results of various factors of external driving forces and virtual passenger flow (**Table 2**) show that the product price is the main driving factor affecting the spatial difference of passenger flow, followed by the type of products, and finally the spatial structure of online marketing. ① Product price. Price is often an important factor in consumers' purchase behavior. Because of its low price, group purchase has become the darling of the market, so the price is one of the driving forces causing the spatial difference of virtual tourism flow. However, the level of group purchase price can not reflect the preferential degree of group purchase products, because high price may be long-term tour

and low price may be short-term tour. There is a significant negative correlation between the discount of group purchase products and virtual tourism flow, indicating that the greater the discount value, the smaller the tourism flow. That is, less product discounts and less tourism flow. This is consistent with the actual situation. It can be seen that the discount of group purchase products is one of the reasons affecting the difference of virtual passenger flow. In order to further analyze the relationship between discount and virtual tourism flow, the two variables are linearly fitted. The results show that they are not a simple linear relationship, indicating that the size of virtual flow is affected by other factors besides product price discount. ② Product type. The size of virtual passenger flow is also affected by product types. The study found that the generation of passenger flow in Guangdong mainly comes from the purchase of vacation products of Dongfang Yintan hotel. The tourism package of Dongfang Yintan luxury Sea View Hotel attracts many tourists because of its high-quality tourism resources and hotel accommodation with large discounts, which makes 65.78% of the tourist sources in Guangdong focus on this product, resulting in a high value of virtual passenger flow in Guangdong; Anhui Huihang ancient road group purchase products concentrated 72.45% of the virtual passenger flow; Tianjin Gefu has launched a group purchase product, but it has also launched a group purchase in Tianjin 12% of tourism flows; Although Guizhou launched only one two-day tour of Zhenyuan and Wuyang River, it attracted a large number of tourism flows and became the high value of tourism flows in Southwest China. Therefore, the type of products is also one of the driving forces affecting the flow direction of passenger flow. ③ Marketing spatial structure. The correlation test between tourism destination network marketing structure and virtual passenger flow shows that tourism destination network marketing structure is one of the driving forces affecting the difference of tourism passenger flow. Here, the marketing structure uses the judgment coefficient of tourism destination group purchase marketing scale distance curve fitting as the

strength of local concentration. The larger the judgment coefficient, the stronger the local concentration of tourism destination marketing structure. The weaker the judgment coefficient, it means that in addition to local concentration, it also has adjacent economic concentration or resource heterogeneous concentration^[20]. It can be seen from **Table 2** that the marketing structure is negatively correlated with the virtual passenger flow. It can be considered that the stronger the local concentration is, the less the virtual passenger flow is. In order to analyze the relationship between marketing structure and virtual tourism flow, the two are curve fitted. The results show that they do not show a simple linear relationship, which shows that marketing structure is one of the influencing factors of the spatial distribution difference of virtual passenger flow, but it is not the only factor. The distribution result of tourism flow is the result of the comprehensive action of multiple factors.

5. Conclusions and discussions

To a certain extent, virtual tourism flow can even reflect the reality tourism flow. Therefore, on the one hand, the research of virtual tourism flow enriches the research of tourism flow in different spaces, but also predicts the flow direction of real tourism flow in advance to a certain extent, so as to make a prediction warning for people flow management and capacity management in the scenic spot, and finally realize the harmonious tourism of the tourist destination and promote the harmonious development of the scenic spot.

(1) The virtual tourism flow of tourist destinations with tourism group purchase products shows weak negative spatial autocorrelation, that is, it shows weak discrete distribution characteristics in space, indicating that tourists show diversified choices to tourist destinations under the guidance of online product marketing.

(2) The virtual tourist flow of tourist destinations with group purchase products shows weak discrete distribution characteristics in the overall space, and the local spatial autocorrelation shows a certain

regularity. In general, the virtual tourist flow is concentrated in the southern coast (such as Hainan, Fuzhou, Guangxi, Guangdong, Zhejiang and Guizhou) and the provinces with rich tourism resources in the central part (such as Shaanxi and Hubei), while smaller in the central-western, northeastern China, and northern China. The “National Day” golden week, the virtual passenger flow of group purchase in North China mainly flows to tourist destinations with mild climate, while the peak season of tourism in Northeast China is mainly around December. Therefore, affected by the climate, the passenger flow flows to these places are less. Due to the influence of network economy, the flow of passenger flow in the western region is less, and only some tourist destinations with rich tourism resources have relatively large passenger flow.

(3) The spatial distribution difference of virtual tourism passenger flow in tourist destination is the result of the comprehensive influence of external, internal driving forces and environmental driving forces. The internal driving force is the thrust to produce the spatial difference of tourism flow, the external driving force is the pull to produce the spatial difference of tourism flow, and the environmental driving force is the supporting condition of the products of spatial difference of tourism flow. The external driving force includes three main driving factors: product price, product type and network marketing space structure. Through correlation analysis, group purchase price is the main external driving factor affecting the spatial difference of tourism flow, followed by product type and finally network marketing space structure. These external dynamic factors and virtual passenger flow are not simply linear.

Based on the three group buying websites, this paper attempts to explore the spatial distribution difference of online group buying virtual tourism flow and the dynamic mechanism of spatial distribution difference, but the number of research websites needs to be expanded to make the research more universal. At the same time, the spatial distribution difference of tourism flow is only the performance of

tourism flow in one-dimensional attribute. In the future, the research on virtual tourism flow needs to be reflected in time to realize the two-dimensional research of time and space. The driving mechanism of the distribution difference of online group purchase virtual tourism flow is relatively complex. This paper makes a conceptual discussion on the dynamic mechanism of the spatial difference of virtual tourism flow, and makes a simple and quantitative research on the main external driving forces, but such research is far from enough, and the research on the power mechanism needs to be further discussed.

Conflict of interest

The authors declare no conflict of interest.

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