Revealing the Coupling Relationship between the Geographical Indications of Agricultural Products and Tourism Economy: A Case Study in Sichuan Province

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Abstract. The transformation of geographical indications of agricultural products (GIAP) to tourism has become a hot spot in rural tourism, making the economic behavior of GIAP an important part of the regional tourism economy. This work selects methods such as gray correlation analysis, literature research, information research, etc., and uses agricultural products and tourism economy identified by the national geographical indication as a research object with the national geographical indicator. Empirical analysis of the tourism economic coupling relationship in Sichuan province is conducted. Through the empirical analysis, it is found that the geographical indications can promote research conclusions such as the development of tourism economy while there is a coupling relationship between the GIAP and the tourism economy.

Keywords:Geographical indications of agricultural products; tourism economy; coupling relationship; relevance; Sichuan province.

1. Introduction

Geographical indications of agricultural products (GIAP) refer to the quality, reputation, or other characteristics of the product owned by the product in a specific area depending on the natural factors or human factors unique to the place of production, and the agricultural products named after the approval of geographical names were reviewed and approved by relevant government departments. With the arrival of the Volkswagen Tourism era and the high -quality development of tourism in the whole region, GIAP have become one of the main types of agricultural products in the rural tourism market, which greatly promotes the tourismization of geographical signs. The transformation of geographical signs agricultural products to tourism has made the economic behavior of geographical signs an important part of the tourism economy.

In terms of the investigations of GIAP, many scholars believe that them could generate economic value to the related regions. For instance, CarinaF et al. analyzed the impact of different geographical indicators in Europe on their origin. The conclusions they draw are that geographical indication agricultural products have promoted the development of local rural areas [1]. Cheng and co-authors proposed that in the construction of geographical signs into the brand culture, the high -quality and good reputation of geographical indications, coupled with consumers' high recognition of the brand, can greatly improve the economic benefits of products [2]. Thansisk revealed that the brand construction of geographical indications has a promotional role in the development of agricultural products and tourism industry in the region and the formation of industrial clusters [3]. Likoudisz et al. believed that geographical signs have strong condensation, which can condense producers engaged in the same industry in their region, thus condensing production forces and promoting the development of regional industries and economy [4]. JeongWooks pointed out that public brands in the regional area of geographical indication agricultural agriculture can promote regional economic development and create a characteristic agricultural brand economy [5]. Williams et al. studied the geographical logo products in New Zealand, and obtain the protection and use of geographical signs. It can obviously bring good economic benefits to rural areas [6]. Sarahb mentioned that geographical indications can help protect products and promote the sustainable development of society, environment, and economy [7]. Regarding the research on the tourism economy, ADY and ABRAHAM have played an important role in the local tourism Advances in Economics and Management Research ISSN:2790-1661

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industry through investigation of central residents of Florida [8]. Samuel conducted a detailed analysis of the economic role of tourism in terms of income, output, value -added, etc. [9]. Spinthiropoulos has inspected the role of two Greek economic departments and taxes in economic growth, confirming that tourism and agricultural taxes have contributed greatly contributing to GDP growth rates. At the same time, there are many research results between the interaction between tourism and the economy [10]. For example, AkinBoad used a causal analysis method to study the interactive relationship between South Africa's international tourism revenue and economic growth, which proves that there is a one -way causal relationship between international tourism industry has a positive impact on Malaysia's economic growth [12]. Can used panel data to explore the economic growth and interaction between the Mediterranean coast of Asia, Europe, and Africa, and obtain the role of the two depends on the national and tourism indicators [13].

In the present work, based on the research objects of agricultural products and Sichuan Province's tourism economy identified by the National Geographic Logo, the methods such as gray correlation analysis, literature research, information research, and associated measurement models were well used. Research and empirical analysis of tourism economic coupling relationships were performed. This study aims to strengthen the awareness of the brand of agricultural products in tourismized geographical indications, and actively highlight the market benefits of GIAP. In addition, this work can also provide a reference basis for the fast development and construction of agricultural products and the tourism economy.

2. Investigation procedurals

2.1 Research method

The coupling relationship, originally a physical concept, refers to the phenomenon where two or more systems or forms of motion in two domains influence each other through various interactions. Later, this concept was gradually introduced in fields such as biology, ecology, agronomy, geography, etc. Through the study of system relationships, the interaction and influence between systems or elements were described, and further behavior of the system was judged.

In the present work, the grey correlation degree for coupling analysis was employed. The relevance, or the degree of correlation, is a measure of the degree of correlation between factors in two systems that vary over time or different objects, known as the degree of correlation. In the process of system development, if the trend of changes in two factors is consistent, that is, if the degree of synchronous change is high, it can be said that the degree of correlation between the two is high; On the contrary, it is lower. Therefore, the grey correlation analysis method is a method of measuring the degree of correlation between factors based on the degree of similarity or dissimilarity in their development trends, also known as the "grey correlation degree".

2.2 Data source

Following the principles of science, acquisition, systematic, comparability, etc., the statistical data from "Sichuan Statistical Yearbook (2011-2021)", "Sichuan Economic Yearbook (2011-2021)", "Sichuan Tourism Yearbook (2011-2021)" published by the governments were chosen. The authoritative statistical data released to the society publicly, and the national geographical indication agricultural product information issued by the national geographical indication agricultural product query system, so the authenticity, reliability, and authority of original data collection have greatly guaranteed.

3. Results and discussion

Given that Xi=(xi(1),xi(2),...,xi(n)) was the behavior sequence of the Xi, D denotes the sequence calculation, and XiD=(xi(1)d,xi(2)d,...,xi(n)d). It can be calculated as follows::

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$$x_{i}(k) = d \frac{x_{i}(k)}{\overline{x_{i}}}, \overline{X_{i}} = \frac{1}{n} \sum_{k=1}^{n} x_{i}(k); k = 1, 2, \cdots, n$$
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The so-called degree of correlation ri(k) essentially refers to the degree of difference in geometric shapes between curves. Therefore, the difference between curves can be used as a measure of the degree of correlation. The minimum difference between two levels is the minimum value of all absolute differences, denoted as $\Delta(Min)$. Similarly, the maximum difference between two levels can be recorded as $\Delta(Max)$. Among them, ρ is known as the resolution, which is usually 0.5 before 0 to 1. It is used to weaken the excessive Δ max and cause the associated factor to reach the effect. It is believed that the introduction of this coefficient is to improve the significant differences between the associated coefficients. The formula can be expressed as:

$$r_i(k) = \frac{\Delta(min) + p\Delta(max)}{\Delta_i(k) + p\Delta(max)}, \rho \in (0,1), k = 1, 2, \cdots, n; i = 1, 2, \cdots, m$$
(2)

Due to the fact that the degree of correlation between each comparative sequence and the reference sequence is reflected through n correlation coefficients, the correlation information is scattered, making it difficult to compare as a whole. As a concequence, it is necessary to centralize the processing of related information. In general, finding the average is a way of centralizing information. The relevance, ri, known as the average value of the correlation coefficients between the comparative sequence and the reference sequence in each period is used to quantitatively reflect the degree of correlation between these two sequences. The calculation is shown as follows:

$$r_{i} = \frac{1}{n} \sum_{k=1}^{n} r_{i}(k), i = 1, 2, \cdots, m$$
(3)

As shown in Fig. 1, it is observed that the international tourism foreign exchange earnings (million US dollars), domestic tourism revenue (billion RMB), the number of domestic tourism (million), the number of inbound tourism (million), total tourism revenue (billion), total number of receptions (billion), number of travel agencies, and the number of star hotel in Sichuan province exhibited the same growth trend with the GIAP from 2010 to 2019, especially in the years 2016-2019. It should be noted that there was a dramatic decrease in the tourism economic data, which can be attributed to the obvious economic downturn resulting from the fast transmission of the COVID-19. In addition, the change in the number of five-star hotels is highly correlated with the evaluation system and policies. Therefore, in further evaluations, the number of five-star hotels will no longer be analyzed and discussed in depth.

The remaining seven indicator values were subsequently averaged with the GIAP data of Sichuan province and verified using grey correlation, as displayed in Fig. 2. Combining the above correlation coefficient results for weighting, the final correlation value is obtained. And the relevance was used to rank the evaluation of 7 evaluation objects; The correlation value is between 0 and 1, and the larger the value, the stronger the correlation between it and the "reference value" (parent sequence), which means its evaluation is higher. From the practice of geographical indication agricultural products in Sichuan Province, with the development of rural tourism and global tourism, geographical indication agricultural products are transitioning towards tourism, which can effectively increase domestic tourism income. The continuous increase in the output value of geographical indication agricultural products can effectively promote the development of international tourism foreign exchange income. As illustrated in Fig. 2, All values are between 0.77 and 0.87, indicating a high correlation with GIAP. Moreover, it is clear that for the seven evaluation items in this study, total number of receptions has the highest correlation with geographical indication agricultural products, while the international tourism foreign exchange earnings have the lowest correlation with the number of GIAP. Therefore, the total number of receptions can be regarded as a reliable indicator to show the variations of the GIAP.

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Fig. 1 Comparison of tourism economic data and geographical indications of agricultural products (GIAP) in Sichuan province from the year 2011 to 2020. (a) International tourism foreign exchange earnings, (b) domestic tourism revenue, (c) number of domestic tourists, (d) number of inbound tourists, (e) total tourism revenue, (f) total number of receptions, (g) number of travel agencies, and (h) number of star hotel.



Fig. 2 Grey correlation degree and ranking of tourism economy and geographical indication agricultural products in Sichuan Province

4. Summary

In summary, there is a high correlation between GIAP and the international tourism foreign exchange earnings, domestic tourism revenue, the number of domestic tourism, the number of inbound tourism, total tourism revenue, total number of receptions, number of travel agencies. This indicates that there is a close relationship, interaction, and coupling relationship between geographical indication agricultural products and tourism economy. The development of GIAP can promote the development of tourism economy such as domestic tourism income and international tourism foreign exchange income. At the same time, the development of domestic tourism income and international tourism foreign exchange income can promote the development of geographical indication agricultural products. Furthermore, promote the development of tourism economy in Sichuan Province. At the same time, the development of tourism economy in geographical products. Furthermore, promote the development of tourism economy in Sichuan Province. At the same time, the development of tourism economy in geographical products.

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