Research on the driving mechanism of tourism regional brand development of tea production base based on the difference-in-difference method

Yanghao Ye, Qing Wang*, Jie Zhu, Wei Ma, Yajuan Huang
Changsha University of Science & Technology, Changsha, China

Corresponding author and e-mail: Qing Wang, wangqing@csust.edu.cn

Abstract. A perfect tea production base can promote the development mechanism of regional tourism brand and improve the evaluation value of regional brand. A complete driving mechanism of regional tourism brand development of tea production base can promote the local economic development and the improvement of national economy. And with a certain scientific mathematical model to evaluate the role of this mechanism is the necessary content of the development of this mechanism. As a result, this article adopts the Difference-in-Difference to analysis tea production base of regional brand, and study on the use of Difference-in-Difference of the various influence factors on the role of the output value. It gives a series of comparison of the predictive value and the actual value, and found the problems about tea base and related regional brand, and put forward the corresponding opinions and suggestions.

1. Introduction
In recent years, with the development of economy and the improvement of people's life quality, more and more people tend to use tourism for entertainment, and are no longer limited to the direction of urban tourism, but are willing to try the rural tourism route, rural tourism has gradually become an entertainment trend. According to the In-depth Research and Investment Prospect Forecast Report of China's Rural Tourism Industry in 2017-2021, the average annually growth rate of China's rural tourism visitors and business revenue respectively are 32.0% and 26.2%, from 2012 to 2016. Among them, China's rural tourism tourists reached 2.4 billion in 2016, and the total revenue reached 480 billion yuan, accounting for 12.2% of the total revenue of domestic tourism. In 2017, the number of rural tourists in China reached 2.5 billion, and the scale of tourism consumption has exceeded 1.4 trillion yuan [1]. At the same time, the tea industry continues to expand, and the tea culture is gradually gaining popularity. At present, China's tea garden covers an area of 1.35 million hectares, ranking the first in the world, with a tea yield of one million tons [2]. Regional brand refers to the regional characteristics of a region (such as unique folk customs, ethnic architecture, clothing, handicrafts, history and culture, etc.) into the image and logo of the region. As one of the representatives of Chinese traditional culture, if tea base is used to build it into a regional brand, as a regional symbol, a regional symbol, the benefits brought by its brand effect cannot be underestimated. Liu Xiaohua believes that the management concept and management mode of modern tea base are of great significance for promoting tea eco-tourism enterprises to adapt to the market development trend. Therefore, tea eco-tourism enterprises need to pay attention to the innovation of their own
management mode, so as to build a guarantee for their sustainable development [3]. With the rapid development of big data, Liu Yue analyzed the application of new media and big data in tea tourism marketing to promote the building of tea tourism brand image [4]. Tang Qian et al. believe that it should vigorously develop high-quality and efficient tea production bases and achieve large-scale and regional tea production. For example, after the implementation of a series of construction projects in Mingshan County, Sichuan, the annual output of tea leaves increased from 6,210 tons in 2000 to 17,238 tons in 2005, with an average annual growth of 35.52% and an average annual increase of 2205.60 tons. The annual output value of tea increased from 85.515 million yuan in 2000 to 34.85501 million yuan in 2005, with an average annual growth of 61.52% and an average annual increase of 526.07 million yuan [5]. Wang Tingyong et al. [1] thought it insist the strategy of leading brand driving and diversified development of characteristic brands. Wang Xue using experience economy theory, STP theory as the foundation, comprehensively used the method of literature research, market research, the company's production environment, natural geographical environment, the tourists' preferences and the basic characteristics, prospect of tea culture tourism to the investigation and study and system analysis. Aiming at the shortcomings of the company, from the subdivide market positioning, improve the software and hardware facilities, improve the quality of the tea culture tourism, and integrated marketing strategy, expand the tourism market, pluralistic strategy, to the value of tourist demand and so on optimizing the operation of the company some targeted policy measures are put forward [6]. They are analyzed from different aspects tea production base in promoting economic development and brand development, in view of the above research, there is no literature uses mathematical models to scientific evaluation of tea production base of tourism regional brand development impetus mechanism research. Thus, this article adopts the double difference method for the analysis of tea production base of tourism regional brand development drive mechanism, which has important significance on the tea production base for the development of local tourism mechanism of regional brand, promote the improvement of the local tea industry economy, and meet the new situation and new demand of the tourism industry.

2. Principle
In this paper, the Difference-in-Difference model is adopted to study whether the tea production base has a positive effect on the driving mechanism of tourism regional brand development. The area with tea production base is set as the experimental group, while the area without tea production base is set as the control group. The specific model is as follows.

\[ Y_{it} = \beta_0 + \beta_1 \text{DID}_{it} + \beta_s \text{Control}_{si} + u_i + v_t + \epsilon_{it} \]  

Where, \( i \) is region, \( t \) is time, \( Y_{it} \) is brand value assessment, \( \text{DID}_{it} \) is core explanatory variable, whose expression is \( \text{DID}_{it} = (H_i \times T_i) \). \( H_i \) is the region where whether set a tea production base. If \( i \) area have tea production base, \( H_i = 1 \), if not, \( H_i = 0 \). \( T_i \) is the dummy variable of the establishment time of tea production base. Before set the tea production base, \( T_i = 0 \), after set the tea production base \( T_i = 1 \). \( \text{Control}_{si} \) is S control variables, \( \beta_s \) is the coefficient of the S control variable, \( u_i \) is regional effect, \( v_t \) is time fixation effect, \( \epsilon_{it} \) is random interference term.

The principle of DID can be shown in the figure below:
At the same time, in order to compare the accuracy of the prediction data horizontally, the data from 2007 to 2017 are selected for multiple linear regression model analysis. The specific model is as follows:

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \mu$$  \hspace{1cm} (2)
\( Y \) is the GDP of Sichuan province, \( X_1 \sim X_5 \) represent six different influencing factors. \( \alpha_0 \sim \alpha_5 \) represent the regression coefficient of the model, \( \mu \) random error term.

3. The experiment design
According to research Angrist and Difference-in-Difference required prior to the implementation of the experimental group and control group of brand value evaluation value should have the same trend[7], the tea production can directly affect the production output of the production base, tea sales can directly reflect the value and popularity of tea, tea trade market to the total number of stalls can reflect how much tea output channels, tea production machinery number can be on behalf of tea mechanization production efficiency, the tea acreage directly reflects the size of the production base itself as well as the ability to output of tea base. Therefore, this paper adopts these five impact factors to analyze the degree of influence on regional brand mechanism. To this end, this paper uses the data (2007-2017) before the implementation of the method for balance test, as shown in the table1:

| Year | Sichuan province GDP(Hundred million) | Tea production (10 kt) | Turnover in the tea market(10 k) | Total number of stalls in the tea market | Number of tea processing machines(10 k) | Tea picking area(kh) |
|------|--------------------------------------|-----------------------|---------------------------------|----------------------------------------|---------------------------------------|---------------------|
| 2007 | 10562.39                             | 13.73                 | 15763                           | 86                                     | 0.5                                   | 116.7               |
| 2008 | 12601.31                             | 13.93                 | 19880                           | 95                                     | 0.91                                  | 124.9               |
| 2009 | 14151.28                             | 15.74                 | 23061                           | 108                                    | 1.27                                  | 138.1               |
| 2010 | 17185.48                             | 16.93                 | 28903                           | 172                                    | 1.92                                  | 148.5               |
| 2011 | 21026.68                             | 18.97                 | 29873                           | 185                                    | 2.23                                  | 167.2               |
| 2012 | 23849.8                              | 20.92                 | 32579                           | 197                                    | 3.1                                   | 186.7               |
| 2013 | 26392.1                              | 21.95                 | 37080                           | 210                                    | 3.36                                  | 203.1               |
| 2014 | 28536.7                              | 23.40                 | 49800                           | 232                                    | 4.57                                  | 216.4               |
| 2015 | 30053.1                              | 24.84                 | 50000                           | 260                                    | 14.87                                 | 229.8               |
| 2016 | 32680.5                              | 26.51                 | 78857                           | 326                                    | 5.22                                  | 236.5               |
| 2017 | 36980.2                              | 27.78                 | 61800                           | 326                                    | 6.71                                  | 252.4               |

In order to maximize the number of sample observations, the sample time is set from 2007 to 2017 in this paper. The explained variable is GDP value of Sichuan Province. Tea yield, turnover amount of tea market, total number of stalls in tea market, tea processing machinery book and tea picking area are the influencing factors that affect GDP value of Sichuan Province from all aspects of tea production base.

4. Discussion and analysis
According to the analysis of statistical data in Table 1, with the growth of various mechanisms in the tea industry, the GDP of Sichuan province also increases. As shown in Figure 4-8, Difference-in-Difference finds that the tourism regional brand development mechanism driven by the tea production base plays a promoting role in the placebo test from multiple angles. Table 2 shows the predicted data and actual values for 2018 and 2019 based on relevant impact factors:

| Year | Tea production (10 kt) | Turnover in the tea market (10 k) | Total number of stalls in the tea market | Number of tea processing machines (10 k) | Tea picking area (kh) | Sichuan province GDP (Hundred million) Predictive value | Sichuan province GDP (Hundred million) Actual value | Relative error r(%) |
|------|-----------------------|---------------------------------|----------------------------------------|----------------------------------------|---------------------|------------------------------------------------------|-------------------------------------------------|---------------------|
| 2018 | 30.07                 | 72350                           | 348                                    | 7.25                                   | 277                 | 41069.45                                             | 40678.1                                         | 0.962               |
According to table 2 of the forecast data in 2018 and 2019, the predicted value is basically the same as the actual value, and the relative error is very small. The histogram of figure 3 shows obviously small difference between the predicted value and the actual value in each year:

Figure 3. Comparison between predictive value and actual value in 2007-2019.

Figure 4. Relationship between tea production and GDP of Sichuan province.

Figure 5. Relationship between turnover of tea and GDP of Sichuan province.

Figure 6. Relationship between tea market number and GDP of Sichuan province.

Figure 7. Relationship between number of tea production machines and GDP of Sichuan province.
Figure 8. Relationship between acres of tea-picking land and GDP of Sichuan province.

It can be seen from the relationship between each impact factor and output value in the scatter diagram above that each impact factor is highly correlated with GDP of Sichuan province and has a good linearity. Moreover, regression is conducted by using the least square method to test the significance of the regression equation and regression coefficient. Where, the coefficient of determination $R^2 = 0.998$, correction coefficient $R_a = 0.999$, and the fitting effect is good, $P = 0.000$, passed the significance test. The final model of GDP of Sichuan province after taking into the regression coefficient is:

$$ Y = -9183.170 - 196.075X_1 - 0.069X_2 + 36.383X_3 - 152.108X_4 + 175.894X_5 $$  \hspace{1cm} (3)$$

However, from the difference between the predicted value and the actual value from 2007 to 2019, it can be seen that there is still a gap between the predicted value and the actual value in some years, as shown in Figure 3. The main reasons are as follows:

(1) It is difficult to realize mechanization in a large area of tea industry. The implementation of large-scale mechanized planting of tea leaves can indeed liberate labor force and improve labor efficiency. Limited by topographic factors, it is not convenient for large-scale simple operations under the condition of gradient greater than 25°. As shown in Figure 7, in 2015, the number of machinery increased dramatically to 148,700, but the turnover of tea and tea production still did not change much, so the feasibility of realizing mechanized tea base is not high.

(2) There are few tea trading platforms. From 2007 to 2017, the number of trade stalls in the tea market increased from 86 to 326, with a growth rate of only 279%, and from 2016 to 2017, the growth rate is zero, which is not consistent with the rapid development of the economic era. According to the scatter diagram in Figure 4-8, the influence of each impact factor on regional brands can be summarized, there are some suggestions as follows:

(a) Reform and innovation management and operation mode and add scientific elements. Such as supply side structural reforms in Sichuan Chuan tea group which recognised by all parties, promoting the standardization of planting technology makes tea rose from 20 yuan per kilogram to 30 yuan, make the entire province 30 tea samples, only 22 indicators pesticide residues, 2 heavy metals index is lower than the standard value, and at the same time, tea polyphenols and other indicators rank among the top in the country [8].

(b) Strengthen brand marketing strategies to achieve precision marketing. Using the network middlemen marketing strategy [4], at present, most tourist attractions will choose to cooperate with the network middlemen, and take it as one of the important marketing channels. Now WeChat has nearly 550 million active users in an average month, and there are more than 8 million WeChat public accounts of different brands. Therefore, it is a good choice to conduct marketing through WeChat platform. Many tourist attractions will set up their own TWO-DIMENSIONAL code, as long as the tourists use their mobile phones to scan the TWO-DIMENSIONAL code and then add attention, they can timely receive the travel product information pushed by the merchants.
5. Conclusions
Based on Difference-in-Difference to analysis tea production base of the tourism development of regional brand drive mechanism is the focal point, taking Sichuan province as an example, through the double difference method is used to analyze the production situation of tea base, the existing factors such as size and volume of business that degree of these factors and the development of the Sichuan provincial GDP fitting is very good, have different degrees of promoting the development of the GDP of Sichuan province, the comparison of the predicted values and actual values can reflect problems existing in the mechanism of the drawings, double difference method of the double difference value is accurately reflects the contribution to the development of regional brand tea base. This mathematical model scientifically evaluates the research on the driving mechanism of regional brand development in tea production base, which is of great significance to the development of regional brand.

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