

Solve the difficulties of the Millennium Shu Road, help tourism Silk Road

-- Impact of the Opening of the Xicheng High Speed Railway on Tourism in North Sichuan

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Abstract

The construction experiment of Xicheng high-speed railway is based on the balance panel data of six prefecture-level cities in northern Sichuan from 2013 to 2019. First of all, through descriptive statistics and mean test, to understand the average effect of local tourism income, and then through the double difference model and intermediary effect model to test the impact of the opening of Xicheng high-speed and intermediary effect model. It is found that : (1) The opening of Xicheng high-speed railway has significantly promoted the growth of local tourism income in northern Sichuan. After several tests, this conclusion remains true. From the point of view of dynamic effect, the pull of Xicheng high-speed railway to tourism in northern Sichuan is increasing year by year. (2) The intermediary effect test shows that the historical and cultural ancient city effect has obvious influence on the tourism development in northern Sichuan after the opening of the high-speed railway.

Keywords

Xicheng High Speed Railway; Double Difference Model; Intermediary Effect; North Sichuan Tourism.

1. Introduction

For areas with rich natural scenery and many poor counties, tourism is a good way to get rid of poverty and become rich. North Sichuan is sparsely populated, with mountainous and hilly terrain, rich in natural scenery, rich in tourism resources and great potential for development. However, the natural terrain makes the traffic problems hinder the economic development of northern Sichuan, especially in the poor counties of northern Sichuan.

In 2017, the official opening of the Xicheng high-speed railway marked a thousand years of "Shu Road difficult" problem has been completely resolved. As one of the main channels of the "eight vertical and eight horizontal" high-speed railway, the high-speed railway is also the first high-speed railway running through the Qinling Mountains. Its completion connects Xi'an and Chengdu, the starting point of the ancient north-south Silk Road. Its opening also means that it can bring new development opportunities for northern Sichuan.

Mianyang city and Guangyuan city in north Sichuan have opened Xicheng high-speed railway. Whether the opening of high-speed railway can promote the development of local tourism, this paper will explore the policy effect of Xicheng high-speed railway opening on tourism income in north Sichuan by constructing double differential DID model.

2. Literature Review

Sichuan has been a place of transportation inconvenience since ancient times, and attaches great importance to the construction of transportation infrastructure. The emergence of high-speed rail as a new mode of transportation is undoubtedly a great gospel for the development of Sichuan [1].

Therefore, many domestic scholars have carried out different studies on the influence effect of high-speed rail opening and the development of tourism. For example, from the perspective of Sichuan market field research, Zhang Yu studies the impact of the opening of Xicheng high-speed railway on tourism consumption behavior, through the proportion of high-speed rail before and after the opening of tourism frequency as an index for comparative research [2]. Another scholar studies the regional difference between the center degree of high-speed rail network and the population as the endogenous potential factor, and finally explores the growth effect of the opening of high-speed rail on local development [3]. Zhang Xueliang found that the opening of high-speed rail in backward areas brought negative spillover effect [4]. According to the study, Lu Wanbo found that high-speed rail will strengthen the siphon effect of developed areas on backward areas and surrounding areas, and continue to aggravate the unbalanced of economic development [5]. Shi Shuhua further explored the economic development of each city after the opening of high-speed rail from 272 cities with a large sample. He believes that the post-economic effect brought by high-speed rail is far greater than other negative effects. High-speed rail is only way to achieve economic development [6].

As far as the opening of high-speed rail itself is concerned, once the blocked traffic roads are opened, the surrounding economic effects will naturally occur, while for Sichuan, which has natural scenery, The development of tourism brought by the opening of high-speed rail will form agglomeration effect in the short term and promote the development of local tourism economy to some extent. For example, Peng Yao carried out a comparative study on the tourism economy of Guangyuan Station in Xicheng High Speed Railway. The results showed that the opening of Xicheng High Speed Railway promoted the development of local regional economy and broadened the propaganda channels of humanistic landscape resources. Meet the spiritual needs of the public, for the development of social modernization is of great [7]. Ma Hongmei used the double difference DID model to study the high-speed rail economic belt in Guangdong, Guangxi and Guizhou, and found that the construction of high-speed rail has a great driving effect on the tourism industry in underdeveloped areas [8]. But there are also views with the opening of high-speed rail on tourism economic growth. By analyzing the data of 287 prefecture-level cities, Yu Yongze found that the tourism revenue of the western cities with high-speed rail was weaker than that of the eastern cities.

In addition, scholars have found that the opening of high-speed rail for the market structure and industrial structure has a certain optimization role. Huang Zhenyu took the cities along the Beijing-Shanghai high-speed railway as a sample. Through the space economy, it was found that the secondary and tertiary industries of the endpoint cities had spillover and siphon effect for the non-terminal cities, respectively [10]. And Ma Zunping studied the regional economic distribution and market structure of tourist attractions through nuclear density estimation [11].

To sum up, when studying the impact of the opening of high-speed rail on regional tourism development, there are few backward and poor areas, or research methods are mostly used for qualitative analysis. Therefore, it is of great significance to study the tourism income effect of poor areas after the opening of high-speed rail. Based on this, the marginal contribution of this paper lies in:

(1) In the research content, combined with the economic effect of high-speed rail, the introduction of intermediary historical and cultural ancient city indicators to study, in line with

the current protection and promotion of historical and cultural background, enriched the research field of high-speed rail.

(2) The effect of Xicheng High Speed Railway on the development of tourism industry in North Sichuan was investigated by double-difference method based on multiple time nodes.

(3) Based on the background of the era of poverty alleviation, the conclusion of the study is that the opening of high-speed rail has a positive impact on the development of tourism, thus increasing the possibility of tourism development in the field of poverty alleviation in the local poor areas in northern Sichuan.

3. Theoretical Analysis and Research Hypotheses

As an important part of China's transportation foundation, high-speed rail greatly enriches people's travel mode. Compared with traditional means of transportation, high-speed rail has faster operation speed and more advanced communication system [12]. High-speed rail has the dual advantages of high speed and high operating density, which greatly shortens the spatial distance of the city and speeds up the connection speed between regions. To some extent, it has a strong impact on the level of technological innovation, industrial structure transformation and resource allocation efficiency the city [13]. Based on the perspective of tourism economic growth after the opening of Xicheng high-speed railway, this paper explores the influence mechanism of Xicheng high-speed railway on tourism development in northern Sichuan from three angles: attraction effect, structure effect and historical city effect.

3.1. Attraction Effects

High-speed rail has broken the original boundaries between cities and accelerated the cross-regional flow of talent, goods and information [13]. With the increasing convenience of transportation, the possibility of people choosing to travel far increases greatly, and the time and distance between tourist destination and tourist will no longer be the main reason to limit long-distance travel. As a result, the opening of high-speed rail has increased the attraction of tourist destinations, increased the number of tourists, enhanced cultural exchanges, and promoted the of economic development [14].

3.2. Structural Effects

As a means of transportation in the new era, high-speed rail has greatly promoted population mobility and the exchange of knowledge and information, which is a necessary for the tertiary industry and the service industry. Predictably, the opening of high-speed rail will indeed play a positive role in industrial restructuring [15].

3.3. The Effect of Historic Cities

By means of quantitative research, Lei Zexin obtains the historical landscape characteristic zoning and the historical and cultural corridor space of "double core" patch in Taiyuan urban area, which brings great economic effect to the local area [16]. The effect of historical and cultural city can be seen. The influence effect of high-speed railway and the effect of historical city have played the role of two-way attraction of tourism and greatly promoted the development of local tourism industry.

Based on the above analysis, this paper puts forward the following assumptions:

H1: compared with the non-opening of Xicheng high-speed rail area, Xicheng high-speed rail will promote the opening of tourism in northern Sichuan.

H2: the opening of high-speed rail with the historical and cultural ancient city effect to enhance the development of regional tourism.

4. Research and Design

4.1. Model Building

In this paper, the Xicheng high-speed railway is regarded as quasi-natural experiment, and six prefecture-level cities of Guangyuan, Mianyang, Dazhou, Guang'an, Nanchong and Bazhong are selected as the research objects in the field of northern Sichuan province. Taking Guangyuan City and Mianyang City as the experimental group and the other four cities as the control group, the double difference method is used to test the effect of Xicheng high-speed railway opening on the tourism development in northern Sichuan.

A double difference method (DID) is constructed here to test the tourism effect of high-speed rail. The model is as follows:

$$Tour_{it} = \beta_0 + \beta_1 \text{Period} \times \text{After}_{it} + \beta_2 \chi_{it} + \delta_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

The i represents the city, the t represents the year, and the interpreted variable is the local tourism income $Touri$, which is used to measure the tourism development in northern Sichuan. After for Xicheng high-speed rail operation opening time 2017 as the time node ,2017 before 0, other 1, χ_{it} for control variables. This paper adopts the double fixed effect of city δ_i and time γ_t . The main research β_1 coefficient here reflects the effect of the opening of Xicheng high-speed railway on tourism income in northern Sichuan.

The control variable χ_{it} in this model construction selects the primary industry output value to the gross output value (FP), the secondary industry to the gross output value (SP), the tertiary industry to the gross output value (TP), the industrial added value to the gross output value (DP), the local fiscal revenue to the gross output value (RVP), the local fiscal expenditure to the gross output value (EXP), and the total population at the end of the year (TPO) as the control variables, In addition to the total population at the end of the year, The remaining control variables are multiplied by 100. The selection of control variables is mainly based on Wang Jie, Cai Zhijian, Qin Xi and other research [17].

4.2. Empirical Results and Test Analysis

1. Descriptive statistics

(1) Descriptive statistics. This sample is selected as the annual data of six prefecture-level cities from 2013 to 2019. The descriptive statistics of each variable in Table 1 showed that the observed values of each variable were 42, that is, the panel data of six cities for seven years. Among them, the average value of tourism income is 27.9972 billion yuan, the maximum value is 74.253 billion yuan, the minimum value is 6.24 billion yuan.

Table 1. Descriptive statistics

variable	observed value	standard deviation	25% Division	50% Division	75% Division	average value	max	minimum
Touri	42	175.531	140.53	247.165	350.7	279.972	742.53	62.4
FP	42	2.974	15.457	16.630	19.302	17.251	22.368	9.939
SP	42	5.760	41.079	46.601	50.516	45.498	53.145	32.099
TP	42	6.781	32.204	36.080	40.555	37.015	51.462	25.458
DP	42	7.053	29.109	37.559	40.804	35.482	46.484	17.019
EXP	42	9.273	22.395	24.580	34.243	28.230	49.059	15.872
TPO	42	158.258	331.92	471.05	559.8	474.184	759.02	249

In order to understand the policy effect on the experimental group after the opening of Xicheng High Speed Railway, the change trend of the average annual tourism income of the experimental group and the control group before and after the opening of Xicheng High Speed Railway is drawn (Figure 1). As shown in figure 1, the local tourism income of the experimental group and the control group increased before the opening of the high-speed rail in 2017, but both grew slowly. It can be seen that the gap between the experimental group and the control group began to increase significantly. This preliminarily verifies the hypothesis that this study can promote the tourism effect of Xicheng high-speed railway in northern Sichuan. Figure 1 directly proves that the average annual tourism income of the experimental group and the control group is basically the same before the opening of Xicheng high-speed railway, and the difference between the two groups before 2017 is not significant. Thus, the precondition of constructing double differential DID model is formed. Because the trend chart can only briefly and preliminarily verify the hypothesis of this paper, it will be verified by parallel trend hypothesis and other methods.

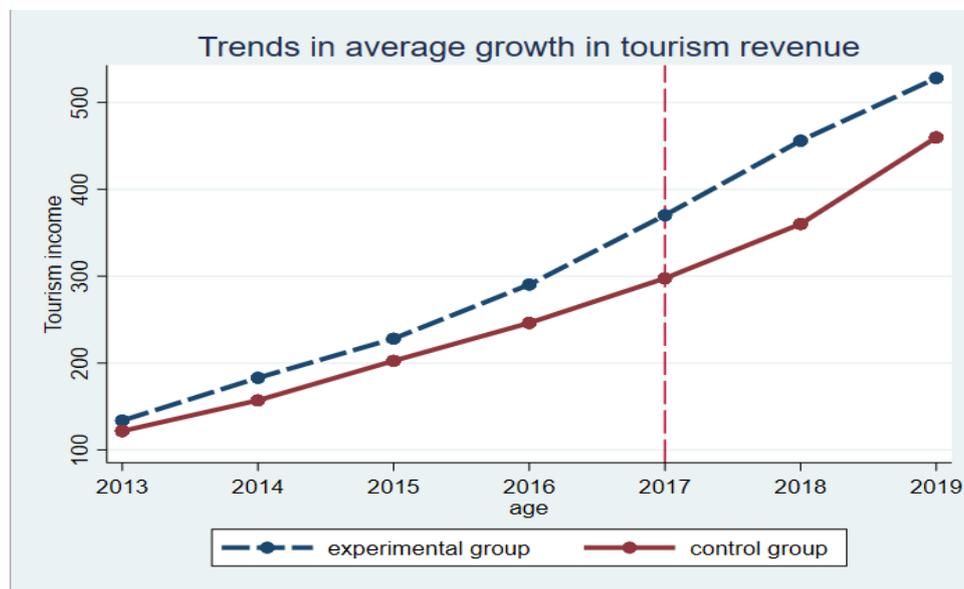


Figure 1. Average Growth Trend of Tourism Income in North Sichuan

(2) Mean test. The difference of mean value between experimental group and control group was tested. The results show that the tourism income of north Sichuan is significantly larger than that before the opening of Xicheng high-speed railway, the proportion of government expenditure to total output value, the proportion of government revenue to total output value and the result of total population at the end of the year are significant, which preliminarily verifies the research hypothesis of this paper. As for the decrease in the proportion of government expenditure to the total output value after the opening of the high-speed railway and the increase in the proportion of government revenue to the total output value, the opening of the Xicheng high-speed railway may affect the growth of tourism income in northern Sichuan, thus promoting the growth of local gross domestic product (GDP). After the opening of the high-speed railway, the local tourism industry develops rapidly, forming agglomeration industry, with the characteristics of increasing people flow and increasing market vitality, which makes the government reduce local fiscal expenditure and financial support and increase local fiscal revenue to a certain extent.

Table 2. Means Test

variable	Period=0	Period=1	Mean Test
Touri	263.5714	312.7736	-49.2021**
FP	18.1869	15.3799	2.8070
SP	45.2759	45.9432	-0.6673
TP	36.1843	38.6756	-2.4912
DP	33.4374	39.5697	-6.1323
EXP	28.8092	27.0714	1.7378
RVP	5.9845	8.3454	-2.3609***
TPO	525.3157	371.9207	153.3950***

4.3. Double Difference DID Benchmark Regression Results

The hypothesis of this paper is that the opening of Xicheng High Speed Railway will promote the development of tourism industry in northern Sichuan, Table 3 is the DID benchmark regression results of this study, That is, the opening of Xicheng high-speed rail on the impact of local tourism income in northern Sichuan. The first column of the table shows, Without the control variables, The coefficients Period×After the interaction terms were significantly positive at 1% statistical level (t 3.94), This indicates that the opening of Xicheng high-speed railway has a significant role in promoting the increase of tourism income in northern Sichuan. Considering that other factors may affect the tourism income of northern Sichuan, So column 2 adds control variables to the regression, The urban City and time variable Year are fixed, The final results show that the increase of tourism income in North Sichuan by the opening of Xicheng High Speed Railway is significantly positive at the statistical level of 5%. Therefore, From the baseline regression, The opening of the Xicheng high-speed railway has significantly promoted the growth of local tourism income in northern Sichuan, The research hypothesis of this paper is well verified.

Moreover, from the control variables, the proportion of tertiary industry to total output value TP and the proportion of government revenue to total output value RVP respectively at the statistical level of 1% and 5% and significantly positive. This is because the tertiary industry is mostly related to tourism catering, accommodation and other service industries, tourism in the development of the service industry at the same time also promote the linkage development. At the same time, the government revenue growth is also due to the rapid development of the tertiary industry, the opening of Xicheng high-speed rail increased its growth effect. In addition, the proportion of government expenditure to total output value EXP at the statistical level of 5% and is significantly negative, which indicates that the increase of government revenue has improved the ability of local independent development.

Table 3. Revenue from West-Cheng High Speed Railway and North Sichuan Tourism

variable	Touri	Touri
Period×After	0***(3.94)	0.034**(2.12)
FP		0.106(-1.62)
SP		0.039**(2.07)
TP		0.004*** (2.92)
DP		0.687(-0.40)
RVP		0.048**(2.01)
EXP		0.088**(-2.54)
TPO		0.000 (7.93)
_Cons	0***(4.20)	0.024**(-2.26)
City	no	yes
Year	no	yes

Note: values in parentheses are t; *, **, *** indicate significant at the statistical level of 10%,5%, and 1%, respectively. The following tables are the same.

4.4. Test of Tourism Dynamic Effect in North Sichuan

According to the basic assumption of constructing double difference (DID), it is necessary to satisfy the parallel trend assumption between the experimental group and the control group. Before the opening of Xicheng high-speed railway, the local tourism income of the selected experimental group and the control group should have the same development trend.

In this paper, the dynamic effect test of the impact of the opening of Xicheng high-speed railway on the tourism income of northern Sichuan is made, and the time and place double fixed effect estimation method is adopted. The model is as follows:

$$Tour_{it} = \beta_0 + \sum_{2013}^{2019} \beta_1 Period \times After_{it} + \beta_2 \chi + \sum \gamma_t + \sum \delta_i + \epsilon_{it} \quad (2)$$

Period×After represents double difference in model (2) DID, so the coefficients β_1 are still examined here. As shown in figure 2, the coefficient β_1 parallel trend test diagram is drawn here. The results show that the parallel hypothesis of constructing double difference model is true.

Table 4 reflects the dynamic effect analysis results of high-speed rail opening and tourism revenue. Based on the regression results, whether or not the control variables are added, the coefficients between 2013 and 2017 before the opening of the high-speed rail are not significant, but without the control variables, the vertical column 1 shows the second year after the opening of the high-speed rail. After adding the control variable, the vertical column 2 showed that the 2019 coefficient was positive and significant at the statistical level of 1%, with a significant change from 10% to 1%, which again showed that the opening of Xicheng high-speed railway had a significant role in promoting tourism income in northern Sichuan.

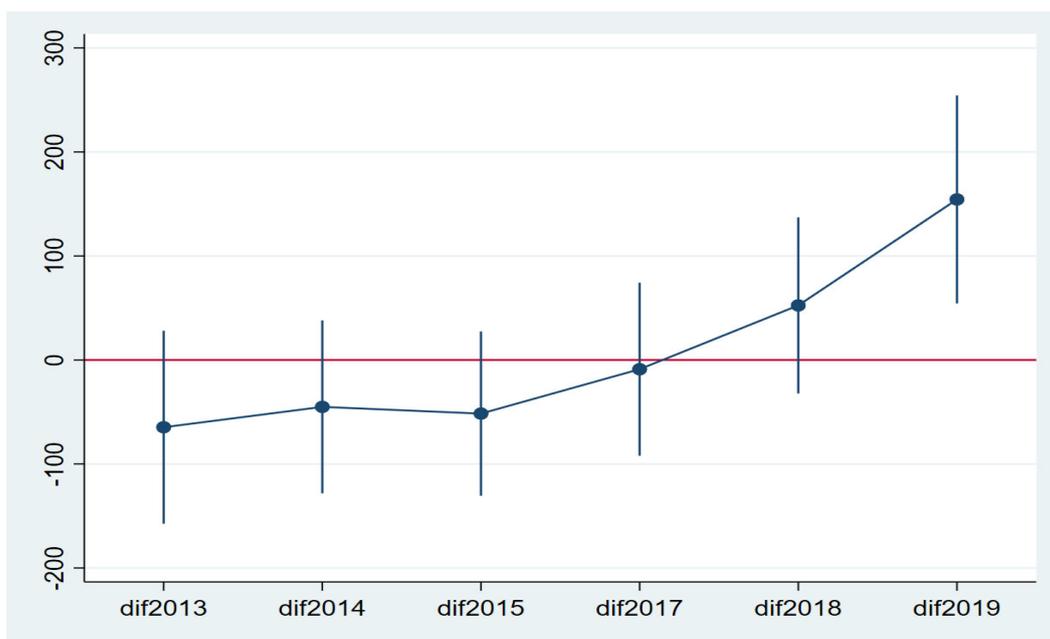


Figure 2. Parallel Trend Test of North Sichuan Tourism (95% confidence interval)

Table 4. Test of Dynamic Effect of High-speed Opening and Tourism Income

variable	Touri	Touri
DID2013	0.192(-1.33)	0.163(-1.44)
DID2014	0.367(-0.92)	0.273(-1.12)
DID2015	0.599(-0.53)	0.190(-1.35)
DID2017	0.501(0.68)	0.827(-0.22)
DID2018	0.168(1.41)	0.213(1.28)
DID2019	0.052*(2.03)	0.004*** (3.19)
_Cons	0*** (8.70)	0.740(0.34)
Controls	no	yes
Urban fixed	no	yes
Time fixed	no	yes

4.5. Placebo Test and Robust Analysis

placebo test is one of the classical test methods in DID double difference result test, which is used by most scholars. To further verify the reliability of the experimental results, a placebo test was performed here to avoid the possible effects of other factors on the regression results. Assuming that the opening time of high-speed rail is three years before the actual opening time (2014) and two years before (2015), a virtual variable is constructed Before3, Before2 in order to re-examine the impact of the opening of Xicheng high-speed rail on the tourism income of northern Sichuan. If the regression coefficient Before3, Before2 the virtual variable is not significant, it shows that in the years before the opening of Xicheng High Speed Railway, there are no other factors that have a significant impact on the tourism income of northern Sichuan, which indirectly proves the reliability of the conclusion of this study.

Table 5 regression results show that the Before3, Before2 coefficients of virtual variables are not significant in statistical sense, indicating that the virtual processing effect constructed in this paper does not exist. The above results show that the opening of Xicheng high-speed railway has a significant impact on local tourism income in northern Sichuan.

Table 5. Comfort test

variable	(1)	(2)
	Touri	Touri
Before3	0.709(-0.38)	
Before2		0.566(0.58)
Control	yes	yes
Fixed urban City effects	yes	yes
Fixed effects Year time	yes	yes

4.6. Stepwise Regression Test and Analysis of Mediating Effects

Considering the influence of the opening of Xicheng high-speed railway on the local tourism income in northern Sichuan, in order to further determine the positive correlation between the two significant effects. Here, the reg stepwise regression test in intermediary effect test is used to test the influence of potential factors and the stable causality.

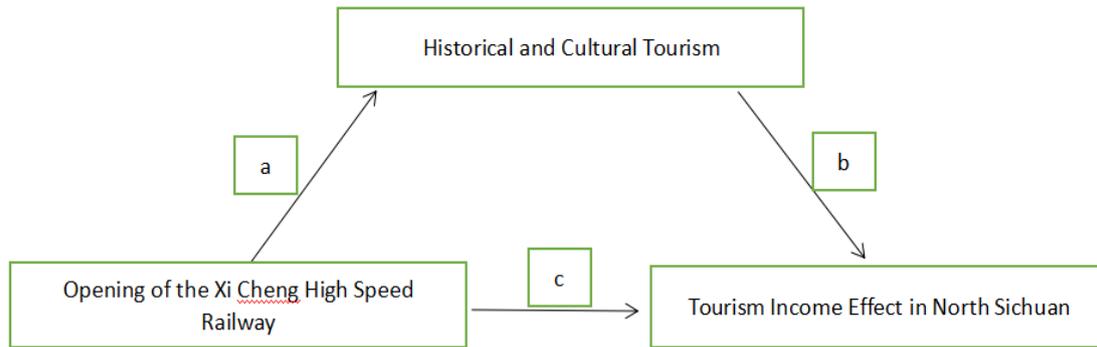


Figure 3. Structure Chart of Median Effect

As shown in figure 3, the intermediary variable selected here is "historical and cultural tourism ancient city ", whether the historical and cultural ancient city plays a great role in the choice of tourist tourists and the propaganda of tourism industry. Whether to open the explanatory variable of Xicheng high-speed railway, through the intermediary variable of historical and cultural tourism ancient city, will ultimately affect the tourism income effect of northern Sichuan.

After analyzing the structure of intermediary effect in this paper, the stepwise regression reg model of intermediary effect is constructed (3):

$$\text{Touri} = c \cdot \text{hsr} + e1 \dots\dots\dots \textcircled{1}$$

$$\text{Oldcity} = a \cdot \text{hsr} + e2 \dots\dots\dots \textcircled{2}$$

$$\text{Touri} = c^* \cdot \text{hsr} + b \cdot \text{Oldcity} + e3 \dots\dots\dots \textcircled{3}$$

As shown in model (3), Touri is the explanatory variable "North Sichuan tourism revenue effect ", hsr is the explanatory variable "whether or not to open the year effect of the Xicheng high-speed rail ", Oldcity as the intermediary variable "whether it is the ancient city of cultural tourism ". a,b, c represent the coefficient effect of the interaction between the three variables, respectively (as shown in figure 3). The "c*" represents the influence of the explanatory variable hsr on the coefficient Touri the explained variable after controlling the intermediary variable. e1, e2, e3 represent the random error terms of their respective models respectively.

The model, as shown in ①, mainly examines the effect of the explanatory variable hsr on the Touri of the explained variable

The model, as shown in ②, mainly examines the effect a; of explanatory variables hsr on the coefficient of influence Oldcity the mediated variables

The model ③ mainly tests the influence coefficient effect of the explanatory variable hsr and the intermediary variable Oldcity and the influence c* of the explanatory variable on the Touri of the explained variable after controlling the intermediary variable

After the construction of the intermediary effect stepwise regression reg model, the stepwise regression of ①②③ was started, and the results were as follows:

Table 6. Stepwise regression reg of mediating effects

variable	(1)	(2)	(3)
	Touri	Oldcity	Touri
hsr	0.008***(2.79)	0.017**(2.48)	0.045**(2.20)
Oldcity			0.029**(2.27)
Control Oldcity	no	no	yes

The results of stepwise regression in Table 6 show that the influence coefficient of explanatory variable hsr on the Oldcity of intermediary variable is significantly positive, which reflects the influence effectiveness of intermediary variable "historical and cultural tourism ancient city ". This paper discusses the influence of explanatory variable on the historical and cultural tourism ancient city. The influence coefficient of explanatory variable hsr on the Touri of explained variable is significantly positive ,0.008(t value 2.79), and the coefficient is still significantly positive after adding and controlling the intermediary variable Oldcity. This result not only reflects the explanatory variable hsr but also confirms the causal effect of explanatory variable Touri.

4.7. Conclusions and Implications

Based on the causality between the opening of Xicheng high-speed railway and the development of local tourism in northern Sichuan, it is found that after the opening of Xicheng high-speed railway station in prefecture-level cities, Local tourism income increased significantly after the opening of high-speed rail, adding a series of factors (control variables Control) tourism income is still significant. After several tests, it finally shows that Xicheng high-speed railway has a very positive role in promoting the development of tourism economy in northern Sichuan.

In view of this, the implications of this study are as follows:

- (1) Speed up the construction of public transport infrastructure, such as high-speed rail, to help lift tourism out of poverty. As a bridgehead in Sichuan Province, North Sichuan has abundant resources. Strengthening infrastructure construction, especially public transport infrastructure, is the lifeblood of connecting and transporting "fresh economic blood ". This study shows that in backward areas such as northern Sichuan, improving basic transportation construction plays an important and positive role in local tourism. Therefore, the local government should actively introduce investment in road repair, speed up the construction of transportation facilities such as high-speed rail, tap local tourism resources, expand the local tourism market, and make it a key weapon for poverty alleviation in northern Sichuan.
- (2) Optimize the industrial structure, stabilize the primary and secondary industries and accelerate the development of the tertiary industries. Tourism development and tertiary industry have a great relationship, the development of tertiary industry, can enhance the local industrial service capacity, more publicity and attract tourists. This study shows that tourism income is closely related to the development of tertiary industry. The development of tertiary industry will promote the development of tourism industry and form a significant influence circle with the opening of high-speed railway. Therefore, in the backward and poor areas of northern Sichuan, the local government should also pay attention to the development of the tertiary industry led by the service industry, and strengthen the economic ability of industrial development under the positive driving effect of the opening of high-speed rail.
- (3) Local governments actively develop local historical and cultural characteristics and accumulate their own cultural heritage. Nowadays, the mode of tourism industry and the way of resource development in many places in China are the same. Compared with the hard power of natural landscape, the soft power of cultural background is easier to attract tourists to experience. Therefore, northern Sichuan should actively utilize the rich historical and cultural background of the local area, develop soft power tourism resources, form a unique tourism characteristics, and add glory to the development of the local tourism industry.

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