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Poverty Reduction Effect of Tourism in Contiguous Poverty-Stricken Areas

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Abstract

Based on the panel data of 64 poverty-stricken counties from 2008 to 2017 in the contiguously poverty-stricken areas of Wuling Mountain, this paper constructs a threshold regression model to make a static analysis of the relationship between tourism development and poverty reduction effect in the contiguously poverty-stricken areas of Wuling Mountain. Then, based on the relevant time series data of Hubei province from 1994 to 2017, vector autoregression (VAR) model and error correction (VCEM) model were constructed. Granger causality test, impulse response analysis and variance decomposition were used to conduct a dynamic analysis of the relationship between tourism development and poverty reduction effect in Hubei Province. The results are as follows: (1) From the static analysis results and dynamic analysis results, tourism development can promote poverty alleviation. (2) From the threshold model, we can see that tourism development has a significant nonlinear threshold effect on poverty alleviation, and the estimated threshold value is 0.133; With the gradual improvement of tourism development level, the marginal promoting effect of tourism poverty reduction tends to decrease. (3) VAR and VECM models show that there is a long-term equilibrium relationship between tourism development level and poverty alleviation in Hubei Province. Tourism development has a certain lag effect on the alleviation of regional poverty, but in the short term, the increase of disposable income has a greater effect on poverty reduction than the level of tourism development. (4) According to the results of Granger causality test, there is a two-way Granger causality relationship between tourism development level and poverty alleviation in the short term, but in the long term, the improvement of tourism development level still contributes to the increase of per capita disposable income and has a more powerful effect on poverty alleviation. (5) The results of impulse response analysis also show that the short-term poverty level is affected by its own impact more than the impact of tourism development, and the impact of tourism development level on per capita disposable income is always positive, and in the long run, its impact is higher than the impact of per capita disposable income on its own.

Keywords

Concentrated contiguous poverty-stricken areas, Tourism poverty reduction, Threshold regression, VAR model, Impulse response.

1. Introduction and Literature review

In recent years, China has fully realized the great significance of tourism development to poverty alleviation. Compared with other ways of poverty alleviation, tourism poverty alleviation with its emerging industrial vitality, strong market advantage, strong hematopoietic function, huge driving role, is playing an increasingly significant role in China's current poverty

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alleviation and development, and is becoming a new force in China's poverty alleviation with its acute momentum. For a long time, people have been optimistic about the development trend of tourism poverty reduction.

However, many scholars have found that the area located in the southwest of Wuling Mountain has made great efforts to develop tourism in recent years. Langshan, Baishuidong, Nanshan Ranch and other fine tourist routes have been built with huge investment, hoping to drive the local economic development and reduce poverty. But so far, the return of funds brought by tourism and the increase of farmers' income are not obvious. On the contrary, the over-dependence on tourism has to some extent suppressed the income of farmers and failed to achieve the expected poverty reduction effect. It can be seen that there is a certain gap and complex contradiction between the effect of tourism poverty reduction and the actual effect, which leads to the research on this issue.

The current view that tourism development can reduce poverty is the mainstream of research. Tourism development can reduce poverty by providing jobs, thereby increasing the income of residents in poor areas. Ashley's research confirms this view. He believes that tourism is labor-intensive, and the employment threshold of tourism is low. Tourism development effectively increases the employment channels for residents in poor areas. The production of tourism by-products, such as related souvenirs and crafts, has low technical requirements and also enriched the income sources of residents in poor areas. Governments also play an important role in the various effects of tourism development on regional poverty. Policy preferences for the poor will amplify the effect of tourism development on poverty alleviation. For example, in his study on the poverty reduction effect of tourism development in Brazil, Blake believes that low-income groups can benefit from the local tourism development process. Moreover, if the government further plays its role in income redistribution and issues tax policies that effectively favor low-income groups, the income of the poor group will be doubled. Studies at home and abroad have found that the effect of tourism on poverty alleviation is not only reflected in economic factors such as increasing the income of poor groups, but also in other aspects. Reeder and Brown found that tourism development would promote the improvement of social conditions in poor areas and improve people's living standards. With the development of regional tourism, its related infrastructure will be constantly improved, among which, the improvement of traffic conditions will obviously promote, and the convenience of transportation will promote the foreign exchange of poor areas, and finally play a role in poverty alleviation.

In the process of research, some scholars believe that tourism development does not necessarily promote the alleviation of poverty, and even has a deepening impact on poverty. Some scholars believe that in the process of tourism development, although low-income groups can obtain certain benefits, but compared with middle and high income groups, the benefits are very different. When studying the effect of tourism development on poverty alleviation in Thailand, Wattanakuljarus found that tourism development improved the income of middle and high income groups far more than that of low income groups in Thailand. In addition, tourism development reduced the income of other trade sectors closely related to poor people, further widening the wealth gap between high and low income groups. Increasing poverty in the country. Some scholars have found that tourism development is easy to lead to the existence of economic leakage in poor areas. Due to the deficiency of their own conditions, the development of tourism in poor areas depends on the support of foreign capital, and the development of tourism is controlled, which makes local residents gain limited benefits from tourism development. Manyara has found that Kenya's tourism development is controlled by foreign forces, and tourism development brings serious economic losses. Local tourism development is likely to become a tool for others to carry out new colonial control, which can not only slow down or even aggravate local poverty level.

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Some scholars have concluded that tourism development is not necessarily related to poverty alleviation through the analysis of domestic and foreign scholars' studies and their own research practices. The effect of tourism development in alleviating regional poverty is determined by many local and social factors. In this study, tourism development in different regions has different effects on poverty alleviation. Due to differences in resource endowment, infrastructure perfection and economic development level, people in different regions also benefit from tourism development differently. Therefore, the benefits brought by tourism development also show spatial differences, which has been verified in the study of Muchapondwa and Stage. At the same time, due to the different roles of different regional governments in the process of tourism development, there are differences in tourism policies, which also lead to the different effects of tourism development on poverty in some aspects. Therefore, there is no direct correlation between tourism development and poverty alleviation.

The current research on the poverty reduction effect of tourism development involves many different perspectives and different research models are used.From the perspective of spatial scale of various studies, Muchapondwa et al. compared the poverty reduction effect of inbound tourism development in Botswana, Namibia and South Africa, starting from several countries with certain commonalities. In contrast, Deller's study on the relationship between tourism development and rural poverty in the United States examines the poverty reduction effect of tourism from the scale of a single country. In China, there are also articles that study the poverty reduction effect of tourism from the scale of a single country. For example, Guo Lufang and Li Ruyou's analysis and test of threshold characteristics of poverty reduction effect of tourism is based on the study of China's inter-provincial panel data. It uses China's inter-provincial panel data from 2000 to 2013. Yang Xia and Liu Xiaoying, who studied the effect of tourism poverty reduction in a region, took the panel data of the western region from 2000 to 2010 as an example to study the relationship between tourism development and poverty alleviation in the western region. It can be seen that domestic and foreign studies on the effect of tourism poverty reduction involve a variety of spatial scales, and different spatial scales will lead to different measurement tools.

Existing researches mainly use national or local statistical data, PTR threshold model, PTSR smooth curve model, error correction model, impulse response analysis and other measurement tools to study the poverty reduction effect of tourism.Based on static econometric analysis, Yang Xia and Liu Xiaoying used computable general equilibrium model to verify the threshold effect between tourism flow and poverty alleviation from two aspects of tourism flow and tourism composition, and concluded that domestic tourism has a significant effect on poverty alleviation in western China and inbound tourism. Based on the dynamic econometric analysis, Zhang Xin et al., based on the data from 1990 to 2012, applied the long-term equilibrium model and Granger causality test and concluded that there is a long-term stable equilibrium relationship between tourism development level and economic growth in China, and there is a two-way Granger causality relationship between economic development and domestic tourism. Zhang Eru et al. established an error correction (VCEM) model based on the gross tourism income and GDP data of Tibet from 1996 to 2016, and found that there was a long-term equilibrium and stable relationship between domestic tourism income and GDP. Simundic B et al. studied the development level of tourism in various regions in southern Europe and found that tourism is a pillar industry in the local area and greatly promotes the development of local economy, proving the hypothesis that tourism drives economic growth. Balcilar M et al. established a vector autoregression (VAR) model based on the data of tourism income and gross domestic product of South Africa from 1960 to 2011, and found that there was a long-term equilibrium relationship between the two.

Through a comprehensive review of the above literature, it is found that the spatial scale of the research and the different measurement tools have influenced the research results of the

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researchers to some extent, which can also explain the reasons for the three relationships between tourism development and poverty alleviation that have been studied at china and abroad.

First, on measurement methods. At present, panel threshold model (PTR), panel smooth transition regression model (PSTR), vector autoregressive VAR model, error correction model (VECM) and impulse response analysis are used to study the effect of tourism poverty reduction. The author believes that PTR and PTSR models adopt static panel data. In fact, tourism development may be a lagging effect on poverty alleviation. Static metrological models cannot accurately describe the relationship between tourism development and poverty alleviation from a long-term perspective. In addition, the poverty level in the lag period is likely to have an impact on the poverty level in the immediate future. Therefore, VECM model can accurately and dynamically describe the short-term and long-term relationship between tourism development and poverty alleviation due to the introduction of long-term equilibrium equation and short-term error correction variables.

Second, with regard to statistical data. At present, on the one hand, studies on tourism development and poverty alleviation mostly use international and inter-provincial panel data with a short time span. However, due to certain heterogeneity of tourism development level and tourism development policies among provinces and countries, some regions are highly likely to underestimate or overestimate the role of tourism in poverty reduction due to high economic development level. On the other hand, the data used in VAR or VECM model are mainly macro GDP, gross domestic tourism income, foreign exchange income of international tourism and other data directly used in the research on the promotion effect of tourism development on economy. In the research on tourism poverty reduction, it is not accurate to directly use GDP as the poverty measurement standard, while micro data such as per capita disposable income and Engel coefficient of urban and rural households can more accurately measure regional poverty level. In addition, it is not accurate to directly measure the level of tourism development based on the macro gross tourism revenue data at home and abroad, because the economic volume is different among regions, and the economic volume itself is large in the economically developed regions, which drives the level of tourism income. Therefore, according to most tourism poverty reduction studies, The author believes that it is more accurate to measure the level of tourism development by the level of tourism specialization (gross tourism revenue /GDP).

Third, On endogeneity. At present, it is difficult to deal with the endogeneity between explained variables and explanatory variables in the research of tourism poverty reduction effect using threshold model, which may lead to biased and inconsistent final parameter estimation results. In addition, finding an instrumental variable that makes economic sense is difficult. Therefore, the author believes that using the error correction model (VECM) model and conducting Granger test in the lag period can more accurately describe the short - and long-term interaction between tourism development level and poverty reduction effect.

2. Empirical research design

2.1. Static model analysis

2.1.1. Model setting

In order to test the nonlinear relationship between tourism development and poverty alleviation, this paper constructs the threshold model as follows:

$$ln\,Y = U_i + (\beta_1 TR_i + \sum_{i=1}^{m} C_i X_i) I_1\,(TR_i \le \gamma) + (\beta_2 TR_i + \sum_{j=1}^{m} C_j X_i) I_2 (TR_i > \gamma) + \varepsilon_i \quad (1)$$

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In Formula (1): i indicates the observed individual; Y is per capita disposable income, which is explained variable; TR_i is the level of tourism development, which is not only the core explanatory variable but also the threshold variable; γ is the threshold value; $I(\cdot)$ is an indicative function. If the threshold variable meets the conditions in parentheses, the value of $I(\cdot)$ is 1, otherwise, it is 0. Is the non-observed fixed effect that does not change with time; Is the random error term conforming to the positive distribution. X_i are other control variables, including the level of fixed asset investment (FAI), the level of government intervention (GOV) and the proportion of non-tertiary industry (IS). U_i is the non-observed fixed effect that does not change with time; $\varepsilon_i$is the random error term conforming to the positive distribution.

2.1.2. Variable specification

The explained variable is per capita disposable income Y. Disposable income is considered to be the most important determinant of consumer spending and is often used to measure people's living standards. Per capita disposable income refers to the sum of consumption expenditure and savings obtained by residents, that is, the income that residents can freely spend. It can be seen that per capita disposable income more effectively reflects the "real income level" of residents, and can more directly reflect the real income level of local residents. For the sake of data availability and comparability, we decided to measure the living standards of local residents by using per capita disposable income in urban and rural areas. The calculation method is based on the algorithm of Guo Lufang and Li Ruyou (2016),Y= per capita disposable income of urban permanent residents × urban population proportion + per capita disposable income of rural permanent residents × rural population proportion.

The core explanatory variable is TR, the level of tourism development. According to the research results of Zhao Lei and Fang Cheng (2017), this paper also uses tourism professional degree (TR) to measure the level of local tourism development. The formula for calculating tourism specialization is TR= total tourism revenue /GDP. The higher the value of tourism specialization, the greater the proportion of local tourism development in local economic development, the higher the level of tourism development.

In order to eliminate the endogenous problems caused by the omission of dependent variables as much as possible, this paper controls the factors that affect poverty alleviation and are also related to tourism development, so as to reduce the impact of endogenous problems. Specific control variables are as follows:

Level of investment in fixed assets. Many literatures related to poverty alleviation introduce the level of fixed assets investment into the model as a control variable for research, and generally show its significant effect on poverty alleviation. Therefore, this paper takes the level of fixed assets investment as a control variable and uses the ratio of fixed assets investment to GDP to express it.

The degree of government intervention. In this paper, the ratio of government expenditure to gross regional product is used to measure the degree of government intervention.

Proportion of non-tertiary industry. The proportion of the added value of the primary industry and the secondary industry in the gross domestic product is used as a measure of the proportion of the local non-tertiary industry.

2.1.3. Data source

The data used in this study span from 2008 to 2017, including 64 impoverished counties in contiguous poverty-stricken areas of Wuling Mountain. For data acquisition and processing, the following instructions are made:

i. The initial data came from the national economic and social development statistical bulletins, government work reports and the statistical yearbooks of each poverty-stricken county in the past years;

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ii. For some missing data and abnormal data, this case is eliminated in this paper.

iii. The total tourism income is obtained from the sum of domestic tourism income and international tourism income, among which the international tourism income is calculated according to the average exchange rate of the current year.

2.1.4. Threshold regression analysis

To investigate whether there is a nonlinear relationship between tourism development level and poverty alleviation, equation (1) should be nonlinear tested, and auxiliary regression equation (2) should be constructed:

$$ln\,Y = b_0 + b_1 TR + b_2 TR^2 + \sum_{i=1}^{m} c_i\,X_i + \varepsilon \quad (2)$$

Then, the "linear test" hypothesis of equation (2) isH_0: $b_2 = 0$, and the alternative hypothesis is H_1: $b_2 \neq 0$.

By putting the collected data into SPSS for nonlinear test, we get b_2=-0.469, and reject the null hypothesis at the 5% level. It shows that there is a nonlinear relationship between the level of tourism development and poverty alleviation. This also confirms that it is reasonable to use threshold model for estimation in this paper.

In this paper, stata15.1 software was used, and mixed OLS model, fixed effect model, and threshold model (including TR primary and secondary terms) were respectively used for estimation. The results are shown in the following table:

Table 1: Model estimation result

Variable	Mixed OLS model(1)	Fixed effect model(2)	Threshold model(3)
TR	1.007(0.224)***	1.256(0.613)**	
TR^2		-0.468(0.175)**	
TR ≤ 0.133			4.587(1.162)***
TR > 0.133			1.451(0.335)***
FAI	0.537(0.169)***	0.541(0.169)***	0.614(0.182)***
			0.870(0.336)***
GOV	0.345(0.319)	0.337(0.321)	1.180(0.451)***
			-0.912(0.428)**
IS	0.911(0.349)***	0.930(0.352)***	0.914(0.466)**
			0.193(0.494)
cons	7.824(0.266)***	7.795(0.274)***	7.398(0.357)***
			8.211(0.347)***
Rsquare	0.2291	0.2300	0.3591

In brackets is the standard error of the estimated coefficient; ***, ** and * respectively represent significant at the statistical level of 1%, 5% and 10%; In Model 3, the coefficients of each control variable were divided into two rows, with the ascending coefficient representing the interval before the threshold value and the descending coefficient representing the interval after the threshold value.

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To sum up, tourism development has a significant effect on poverty alleviation in the above models at different significance levels. However, from the results of parameter estimation, the estimated coefficients of Model 1 and Model 2 are lower than that of model 3, and the significance level is lower than that of Model 3, so there is an underestimation problem. In addition, from the goodness of fit of each model, model 3 has the largest R square value, indicating that it has the best fitting effect and better reflects the threshold characteristics of tourism poverty reduction effect.

Next, Model 3 is analyzed. In general, tourism development level has a significant positive effect on poverty alleviation in different threshold areas. However, with the increase of tourism development level, its marginal effect on poverty alleviation decreases with the increase of the ratio of local tourism to GDP. When the level of tourism development is lower than 0.133, the marginal effect of poverty alleviation is 4.587 for each percentage point increase in the level of tourism development. When the level of tourism development is higher than 0.133, the marginal effect of poverty alleviation decreases to 1.451 for each percentage point increase in the level of tourism development. This is because the barriers to entry for tourism are relatively low. When tourism is in its early stages of development, low-skilled labor can easily obtain employment opportunities, and local residents can benefit from simple farming, restaurant, and local product selling jobs. However, with the improvement of tourism development level, the industry chain of tourism industry is gradually improved, and the local tourism industry is increasingly mature. On the one hand, local residents with higher family endowment and stronger entrepreneurial ability are more likely to have a competitive advantage in the tourism industry and gain greater benefits from the tourism industry, which to some extent widens the gap between the rich and the poor of local residents. On the other hand, the entry of foreign tourism enterprises, in order to improve the comprehensive competitiveness, the demand for employees has also changed from traditional skilled talents to professional knowledge talents, thus raising the employment threshold of the tourism industry, industry barriers further rise. Poor groups have low education and are easy to be replaced by professional groups, and their benefits from tourism are blocked, leading to a gradual decline in the poverty reduction effect of tourism. From the perspective of the two threshold intervals, although the effect of tourism development level on poverty alleviation gradually decreases, the effect is positive, indicating that tourism development still has a positive contribution to the improvement of income level of residents in poor counties and the promotion of poverty alleviation.

In terms of the influence of control variables on poverty alleviation, the estimated results show that both the fixed investment level (FAI) and the proportion of non-tertiary industry (IS) have a positive effect on poverty alleviation in the two threshold intervals, which is basically consistent with the conclusions of existing studies. However, it is found in this study that when tourism development level crosses the threshold interval, government intervention level (GOV) is negatively correlated with poverty alleviation. According to the sample data, in recent years, the level of fiscal expenditure of counties in Wuling Mountain District has been increasing continuously, but the disposable income of residents has not increased significantly. This can be explained from two aspects. On the one hand, the tourism industry is a government-oriented industry. With the improvement of tourism development level, the government also hopes to improve the local window image by improving the service level of tourism, so the requirements on tourism employees are correspondingly increased. Therefore, the income of poor groups through employment in tourism enterprises is blocked, leading to the gradual reduction of the poverty reduction effect of fiscal expenditure, and even widening the gap between the rich and the poor, so that fiscal expenditure has a negative effect on poverty alleviation. On the other hand, the author learned from the interview and research in the rural areas of Wufeng County, Wuling Mountain area that the family endowment and entrepreneurial ability of rural residents have certain heterogeneity, and the tourism industry in villages is generally led by village

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cadres and their relatives. This group has relatively high enthusiasm for tourism and can make good use of national preferential policies to obtain good income through tourism. However, some poor groups have a wait-and-see attitude towards the tourism industry, with low participation and low income from tourism. In addition, in terms of the tourism poverty alleviation policy, there is also an unreasonable bias in the implementation of the policy. Only the families rated as poor can enjoy tourism employment subsidies, while some groups are on the edge of the poverty line and cannot enjoy tourism employment subsidies if they are not rated as poor households, which greatly discourages their willingness to participate in tourism. At the same time, some villagers also revealed to the author that tourism development has widened the gap between rich and poor.

In terms of the marginal effect of control variables on poverty alleviation, the estimated results showed that the marginal effect of fixed investment level (FAI) on poverty alleviation increased from 0.614 to 0.870. Tourism is a labor-intensive industry. With the improvement of tourism development level, regional visibility has increased, and the number of tourists has gradually increased. Therefore, investment in fixed assets should be appropriately increased to match. In addition, after the proportion of the primary and secondary industries (IS) crossed the threshold, the marginal effect on poverty alleviation decreased from 0.914 to 0.193, but its coefficient in the second interval was not estimated to be significant, so this study will not discuss it temporarily.

Table 2: The model removes one explanatory variable at a time

	Remove FAI	Remove GOV	Remove IS
γ	0.132	0.116	0.133
TR(Region1)	3.955(1.200)***	7.063(1.348)***	4.908(1.157)***
TR(Region2)	1.778(0.325)***	1.320(0.332)***	1.464(0.335)***
FAI	-	0.660（0.190）*** 0.543（0.285）*	0.616（0.183）*** 0.888（0.335）***
GOV	1.456（0.467）*** -0.467（0.410）	-	0.857（0.423）** -0.973（0.401）**
IS	0.921（0.451）* 0.366（0.512）	0.361（0.450） 0.664（0.463）	-
cons	7.743（0.358）*** 8.502（0.344）***	7.923（0.315）*** 7.940（0.312）***	8.026（0.159）*** 8.320（0.206）***
R square	0.288	0.321	0.344

In brackets is the standard error of the estimated coefficient; ***, ** and * respectively represent significant at the statistical level of 1%, 5% and 10%; In Model 3, the coefficients of each control variable were divided into two rows, with the ascending coefficient representing the interval before the threshold value and the descending coefficient representing the interval after the threshold value.

This paper tests the robustness of the model by removing the level of fixed asset investment (FAI), the degree of government intervention (GOV) and the structure of non-tertiary industry (IS) from the threshold model one by one. The test results are shown in Table 2, indicating that after removing one control variable one by one, the threshold model still has multiple threshold values, which are 0.132, 0.116 and 0.133, respectively. When the fixed asset investment (FAI) variable is removed, the marginal effect on poverty alleviation decreases from 3.955 to 1.778

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when the tourism development level is above the threshold (0.132). After removing the government intervention (GOV) variable, when tourism development level is above the threshold value (0.116), the marginal effect on poverty alleviation decreases from 7.063 to 1.320. When the proportion of non-tertiary industry (IS) variable is removed, the marginal effect on poverty alleviation decreases from 4.908 to 1.464 when the tourism development level is higher than the threshold value (0.133). This suggests that Model 3's conclusion that there is a threshold effect between tourism development and poverty alleviation is trustworthy. In other words, the threshold model (Model 3) is robust, and the marginal effect of tourism development on poverty alleviation gradually declines.

2.2. Dynamic model analysis

2.2.1. Data selection and indicator description

In order to verify the interactive relationship between tourism development level and poverty reduction effect in Hubei Province, relevant data of this paper were selected from Hubei Statistical Yearbook, Hubei Tourism Yearbook and Statistical Bulletin of National Economic and Social Development of Hubei Province from 1995 to 2018. In this paper, urban and rural per capita disposable income is used to measure the poverty reduction effect (Y). As the explained variable, the calculation method is as follows: per capita disposable income of urban permanent residents × urban population proportion + per capita disposable income of rural permanent residents × rural population proportion; Tourism specialization level (TR) is used to measure the level of tourism development. As an explanatory variable, the formula of tourism specialization is TR= total tourism revenue /GDP. The higher the value of tourism specialization, the greater the proportion of local tourism development in local economic development, the higher the level of tourism development. Since the natural logarithm transformation of data does not affect the co-integration relationship, can also linearize the trend and eliminate heteroscedasticity, in this paper, the natural logarithm of urban per capita disposable income is LNY, and their first-order difference is DLNY and DTR.

2.2.2. Unit root (ADF) test

Before analyzing the dynamic relationship of time series, it is necessary to conduct stationarity test to avoid pseudo regression. In this paper, ADF test is used to test the stationarity of two time series LNY and TR, and the order of lag is determined according to the principle of minimum AIC and SC. For non-stationary, unit root test is carried out after difference.

Table 3: ADF test results

Variable	Inspection form (c, t, m)	ADF	1% Critical value	p
LNY	(c, t, 0)	-1.677153	-4.416345	0.7285
TR	(c, t, 5)	-4.076690	-4.571559	0.0250
DLNY	(c, n, 0)	-4.637312	-3.769597	0.0014
DTR	(c, n, 0)	-4.376880	-3.769597	0.0026

(c, t, m) represents whether the unit root test equation contains a constant term, trend value and lag period. In the test process, the later period is determined by the minimum AIC and SC criteria in eviws7

It can be seen from the results of ADF test that the ADF statistical value of the original sequence of two variables is greater than 1% critical value, and the probability p value is greater than 0.01. The original sequence is a non-stationary sequence with unit root. After first-order difference, the ADF statistics are all less than 1% critical value, and the probability p value is less than 0.01. Besides, there is no unit root in the difference sequence, and LNY and TR are

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first-order unitary, namely LNY~I(1) and TR~I(1), which meets the conditions for further cointegration analysis.

2.2.3. VAR model construction and stability test

In view of the limited number of samples, this paper chooses Johansen co-integration test, which is more effective when there are multiple co-integration relations between variables. Before the co-integration test, the VAR model needs to be estimated. Firstly, the lag period of the VAR model is determined, and the lag period is selected as 3 stages according to the minimum criteria of AIC, SC and HQ.

Table 4: VAR model lag period

Lag	LogL	LR	FPE	AIC	SC	HQ
0	32.11333	NA	0.000144	-3.169824	-3.070409	-3.152999
1	102.4413	118.4471*	1.34e-07	-10.15172	-9.853474*	-10.10124
2	105.2691	4.167201	1.55e-07	-10.02832	-9.531249	-9.944198
3	111.3561	7.688916	1.31e-07*	-10.24801*	-9.552110	-10.13024*
4	114.3360	3.136724	1.59e-07	-10.14063	-9.245901	-9.989208
5	116.5979	1.904779	2.25e-07	-9.957677	-8.864116	-9.772603

The VAR model estimation results of LNY and TR in this paper are as follows:

$$LNY_t = \underset{(0.83507)}{-1.214236}TR_{t-1} \underset{(1.10910)}{-0.497381}TR_{t-2} \underset{(0.76872)}{-0.225883}TR_{t-3} \underset{(0.25255)}{+0.749756}LNY_{t-1} + \underset{(0.31502)}{0.114616}LNY_{t-2} \underset{(0.23517)}{+0.223187}LNY_{t-3} \underset{(0.20593)}{-0.438600} \quad (3)$$

$$R^2 = 0.998 \;\; F = \;\; 1031.057 \;\; AIC = -3.328165 \;\; SC = -2.979991$$

$$TR_t = \underset{(0.05067)}{-0.039548}LNY_{t-1} \underset{(0.06320)}{+0.069043}LNY_{t-2} \underset{(0.04718)}{-0.016791}LNY_{t-3} \quad (4)$$

$$R^2 = 0.950502 \;\; F = 44.80703 \;\; AIC = -6.540692 \;\; SC = -6.192518$$

In brackets is the standard error of the estimated coefficient

The estimated coefficients in the two equations are basically significant, and the goodness of fit of the two equations is high, AIC value and SC value are small, so the overall fitting effect of the equation is good. As can be seen from Formula (3), the absolute values of TR's three parameter estimates are generally larger than those of LNY's three parameter estimates, indicating that LNY is mainly affected by TR's lag period in the short term. The absolute value of the estimated values of three parameters of TR showed a decreasing trend, which indicated that LNY was mainly affected by one stage lag of TR in the short term, and then the effect of TR gradually weakened. In Formula (4), the absolute value of the three parameter estimates of TR is much larger than the absolute value of the three parameter estimates of LNY, indicating that in the short term, TR is still mainly influenced by its own lag period, but not by LNY lag period.

Although we obtained the fitted VAR model in the previous part, and the goodness of fit is high, the stability of this model needs to be further verified. This paper uses AR feature root chart to test the stability of VAR model. The results are shown in Figure 1 and Table 5.

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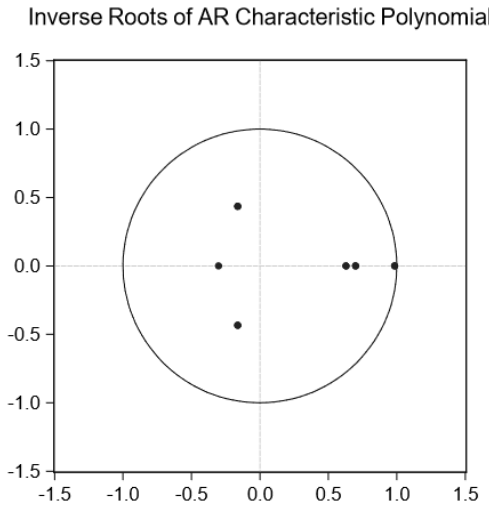

Figure 1: AR test results (Figure)

Table 5: AR test results (Table)

The reciprocal of the eigenroot	The modulus of the reciprocal of the eigenroots
0.984880	0.984880
0.700247	0.700247
0.629927	0.629927
-0.161012-0.434129i	0.463026
-0.161012+0.434129i	0.463026
-0.301750	0.301750

The VAR model with LNY and TR variables lagging for 3 periods has 6 feature roots, and the reciprocal modulus of all feature roots is less than 1. Therefore, the established VAR model is stable and can be tested for co-integration in the next step.

2.2.4. Johansen cointegration test

In this paper, Johansen co-integration test is used to test whether there is a co-integration relationship between LNY and TR. In the test, it is necessary to set the lag order of the test model. Since the optimal lag order determined in this paper according to the selection criterion of unconstrained VAR model is 3, and the lag order selected by co-integration test is equal to the lag order of unconstrained VAR model minus 1, the optimal lag order of Johansen co-integration test is 2. Test variables LNY and TR were set to have deterministic trends. The cointegration equation is set to have no intercept term and definite trend term.

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Table 6: Trace test and maximum characteristic root test results

	Null assumption: Number of cointegration relations	eigenvalue	Trace statistics	0.05 critical value	p
Trace test	No co-integration *	0.549491	29.14303	25.87211	0.0189
	At most one co-integration	0.445887	12.39812	12.51798	0.0523
Maximum characteristic root test	No co-integration *	0.549491	16.74491	19.38704	0.1162
	At most one co-integration	0.445887	12.39812	12.51798	0.0523

As can be seen from Table 6, at the significance level of 5%, when the original hypothesis is no co-integration relationship, the trace statistic is 29.14303 greater than the critical value of 25.87211, so the hypothesis is rejected. However, the original hypothesis is at most one cointegration time, and the trace statistic is less than the critical value, so this hypothesis is accepted. In the maximum characteristic root test, at the significance level of 5%, the original hypothesis was accepted when there was no co-integration relationship or at most one co-integration relationship. Generally speaking, trace statistics test is more accurate and effective, and the trace test results are accepted in this paper. Therefore, there is a cointegration relationship between LNY and TR, that is, there is a long-term stable dynamic equilibrium relationship between tourism development level and poverty alleviation. The cointegration equation between the two variables is. Therefore, in the long run, higher levels of tourism development can help alleviate poverty.

2.2.5. Estimation and verification of VECM vector error correction model

Next, a vector error correction model (VECM) was established on the basis of VAR model to further analyze the long-term equilibrium and short-term fluctuation relationship between tourism development and poverty reduction effect in Hubei Province.

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Table 7: Vecms of LNY and TR

	D(LNY) model (1)	D(TR) model (2)
ECM(-1)	-0.593606	0.055272
	(0.20151)	(0.04494)
ECM(-1) D(TR(-1))	[-2.94586]	[1.22995]
	0.186127	-0.003425
	(0.21132)	(0.04713)
D(TR(-1)) D(TR(-2))	[0.88080]	[-0.07269]
	0.157763	0.051214
	(0.18718)	(0.04174)
D(TR(-2)) D(LNY(-1))	[0.84282]	[1.22685]
	1.070755	-0.201950
	(0.99419)	(0.22172)
D(LNY(-1)) D(LNY(-2))	[1.07702]	[-0.91085]
	1.201559	-0.117837
	(0.86463)	(0.19282)
D(LNY(-2)) C	[1.38968]	[-0.61111]
	0.050528	0.000709
	(0.03218)	(0.00718)
C R-squared	[1.56997]	[0.09882]
	0.408117	0.222108
Adj.R-squared	0.210823	-0.037189
Sumsq.resids	0.021449	0.001067
S.E.equation	0.037815	0.008433
F-statistic	2.068571	0.856578
Loglikelihood	42.51156	74.02255
AkaikeAIC	-3.477291	-6.478338
SchwarzSC	-3.178856	-6.179903

() is the standard deviation; [] is the t statistic

All variables in the vector error correction model (VECM) are written in the form of lag 1 period, and ECM in the table is the error correction item. Since AIC and SC values of VECM are both small, -9.952789 and -9.206702, the overall effect of VECM is good. The error correction coefficient in model (1) is negative, indicating that the disequilibrium error of the previous period will be corrected in a large way, making LNY and TR return from the short-term disequilibrium state to the long-term equilibrium state.

2.2.6. Granger causality test

Based on the co-integration test and VECM model, a preliminary quantitative analysis is conducted on the dynamic relationship between LNY and TR, but the causal relationship between the three needs to be further tested. The table shows the causality test results of LNY and TR.

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Table 8: LNY and TR causal test results

lag	Null hypothesis	obs	F-Statistic	p
1	LNY is not the Granger cause of TR	23	3.90487	0.0621
	TR is not the Granger cause of LNY		11.7023	0.0027
2	LNY is not the Granger cause of TR	22	2.78679	0.0898
	TR is not the Granger cause of LNY		3.82702	0.0424
3	LNY is not the Granger cause of TR	21	2.04377	0.1540
	TR is not the Granger cause of LNY		2.26887	0.1254
4	LNY is not the Granger cause of TR	20	2.40215	0.1128
	TR is not the Granger cause of LNY		2.86107	0.0753

The results of Granger causality test show that LNY and TR have a two-way causal relationship at the 10% significant level in the lag period 1 and 2, indicating that the improvement of tourism development level contributes to the improvement of per capita disposable income in the short lag period, and the increase of per capita disposable income also contributes to the improvement of tourism development level. There was no unidirectional or bidirectional causal relationship between LNY and TR at the 10% significance level in the lag phase 3. TR is a one-way cause of LNY at the 10% significance level of the lag period 4. Therefore, in the long run, the higher level of tourism development still contributes to the increase of per capita disposable income and the alleviation of poverty.

2.2.7. Impulse response analysis and variance decomposition

In order to further analyze the dynamic relationship between LNY and TR, impulse response analysis is carried out on them respectively, and a standard deviation impact is given to LNY and TR respectively, and then the impulse response function graph between these two variables is obtained.

As shown in Figure 2, it can be seen from the first figure that the impact of LNY in the first five periods was greater than that of TR, and LNY gradually declined due to its influence, approaching 0. The influence of TR on LNY increases gradually in the first three stages, then slowly decreases gradually and becomes stable. The influence of tourism development level on per capita disposable income is always positive, but in the long run, the influence gradually becomes close to 0. As can be seen from the second chart, the influence of TR on itself in the first two periods is greater than that of LNY, and the influence of LNY on TR is greater than that of TR on itself. In the first three stages, the influence of LNY on TR increased continuously, and then decreased slowly, gradually approaching 0.7. The influence of TR on itself fluctuated in the first four stages, and then stabilized gradually, approaching 0.65. In the long run, LNY has a positive influence on TR.

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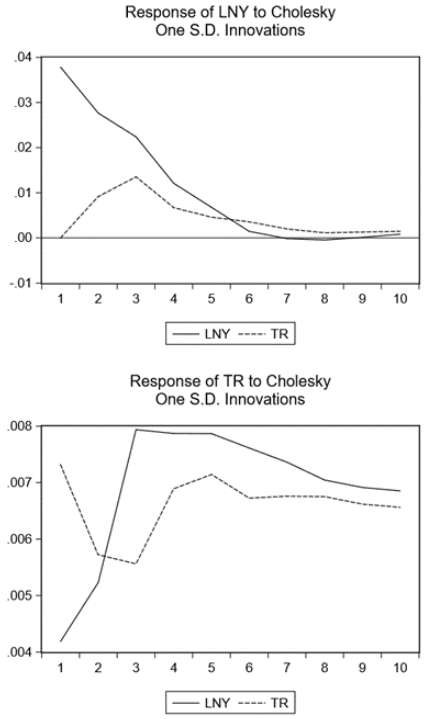

Figure 2: Impact response curve between LNY and TR

Based on the analysis of impulse response model, the influences of different structures on the residual standard deviation of LNY and TR were further analyzed and predicted. In this paper, variance decomposition was used to quantitatively analyze the mutual contribution degree between tourism development level and poverty alleviation in Hubei Province. The variance decomposition results of LNY and TR are shown in Figure 3.

Variance Decomposition

Variance Decomposition of LNY:

Period	S.E.	LNY	TR
1	0.037815	100.0000	0.000000
2	0.047725	96.32180	3.678202
3	0.054426	90.98963	9.010366
4	0.056151	90.12734	9.872661
5	0.056743	89.67874	10.32126
6	0.056872	89.33759	10.66241
7	0.056907	89.22962	10.77038
8	0.056919	89.19713	10.80287
9	0.056934	89.15217	10.84783
10	0.056958	89.09673	10.90327

Variance Decomposition of TR:

Period	S.E.	LNY	TR
1	0.008433	24.63858	75.36142
2	0.011454	34.21271	65.78729
3	0.015004	47.93133	52.06867
4	0.018291	50.77208	49.22792
5	0.021153	51.79867	48.20133
6	0.023464	52.61784	47.38216
7	0.025504	52.87095	47.12905
8	0.027306	52.77881	47.22119
9	0.028935	52.71504	47.28496
10	0.030450	52.66359	47.33641

Cholesky Ordering: LNY TR

Figure 3: LNY and TR variance decomposition results

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As can be seen from the variance decomposition results of LNY, the per capita disposable income of LNY was affected by its own impact in the first phase, and then showed a downward trend, and finally the contribution stabilized at about 89%. The influence of TR tourism development level on LNY gradually increased from 3.68% in the second phase and stabilized at 10.9%. According to the variance decomposition results of TR, TR in the first three stages was influenced more by its own impact than by LNY's impact. The impact of LNY on TR increased gradually and stabilized at about 52%. TR's impact on itself gradually decreases and gradually approaches 47.3%.

3. Conclusions and policy recommendations

3.1. Static model model main conclusions

Tourism development plays an important role in improving per capita disposable income in poor areas and alleviating poverty.However, this effect has significant nonlinear threshold influence. This indicates that tourism development has different effects on poverty alleviation in different stages of development. Moreover, the effect is still robust when controlling variables in the model are removed one by one.

Taking tourism development level as the threshold variable, the estimated results show that the threshold value is 0.133. When the tourism development level is in the two threshold intervals, the alleviation effect of tourism development on poverty level is positive. However, when the tourism development level is higher than the threshold value, the poverty reduction effect becomes smaller, and the marginal promotion effect of tourism development on poverty alleviation gradually declines.

Fixed asset investment level (FAI) and government intervention level (GOV) also have threshold effect on poverty alleviation. With the improvement of tourism development level, the level of fixed asset investment (FAI) has a positive effect on poverty alleviation, and the marginal positive effect is increased. With the improvement of tourism development level, government intervention (GOV) has a certain inhibitory effect on poverty alleviation.

3.2. Dynamic model model main conclusions

There is a long-term equilibrium relationship between tourism development level and poverty alleviation in Hubei Province. Tourism development has a lag effect on poverty alleviation, but in the short term, the increase of disposable income has a greater effect on poverty alleviation than the level of tourism development. The VECM error correction coefficient of economic growth is -0.593606, indicating that the imbalance error of the previous period will be reversed by 59.36%, making tourism development level and per capita disposable income level return from short-term imbalance to long-term equilibrium.

According to the results of Granger causality test, there is a two-way causal relationship between tourism development level and poverty alleviation in the short term. From the perspective of long-term observation, the steady improvement of tourism development level still contributes to the increase of regional per capita disposable income and has a more powerful effect on poverty alleviation. On the one hand, tourism development provides a large number of jobs and drives the transformation of related industries. At the same time, it greatly stimulates the comprehensive improvement of economy with the help of the "multiplier effect", which increases per capita disposable income and effectively alleviates the poverty level. On the other hand, with the increase of per capita disposable income, residents' travel demand increases and the number of trips increases, which promotes the development of tourism.

The results of impulse response analysis show that: compared with the change of per capita disposable income level caused by tourism development, the data of the first five periods show that the impact of income level caused by its own impact is obviously more severe, and then the

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impact of its impact gradually declines and approaches zero as time goes by; According to the data of the first three periods, the per capita impact of tourism development will gradually rise, reach the peak in the third period, and then show a slow decline trend and tend to zero. The influence of tourism development level on per capita disposable income level is always positive, and in the long run, the influence degree is also higher than the influence of per capita disposable income level itself. In the first two periods, the impact of tourism development level on its own is greater than that of per capita disposable income level on tourism development level, after that, the impact of per capita disposable income level on tourism development level is greater than that of tourism development on its own. In the first three periods, the impact of per capita disposable income on the level of tourism development increased continuously, and then slowly decreased, gradually approaching 0.7. The influence of tourism development level on itself fluctuates in the first four periods, and then becomes stable gradually, approaching 0.65. In the long run, per capita disposable income has a positive influence on tourism development.

Through variance decomposition, it can be concluded that the fluctuation of per capita disposable income is mainly affected by its own factors, with its own contribution up to 89%; In the short term, the fluctuation of tourism development level will be affected by its own, but in the long term, per capita disposable level is the real main influencing factor, with a contribution of about 52.7%.

3.3. Comprehensive conclusion

Based on the results of static model and dynamic model, from the perspective of horizontal tourism development level and vertical tourism short-term and long-term development level, it is shown that tourism development plays an important role in improving regional per capita disposable income and alleviating poverty. This conclusion has been empirically tested in this study. In this reality, we should unswervingly choose, guide and develop tourism in order to alleviate poverty.

According to the results of static threshold regression model, there is a threshold effect between tourism development level and poverty alleviation. When the tourism development level is higher than the threshold value, its poverty reduction effect becomes smaller, and the marginal promotion effect of tourism development on poverty alleviation gradually declines. With the continuous expansion of tourism scale and the increase in the number of tourists, the contradiction between the growing demand of tourists in tourism areas and the backward service level is gradually intensified due to the limitation of the quality of employees in poor areas. Under the existing reception capacity, it is increasingly difficult to meet the expansion of the market, the conflicts between tourists and scenic spot staff increase, and the image of the destination is damaged. On the other hand, the lack of cultural exploration of the destination makes the attraction of the scenic spot gradually decline. The above factors lead to the increase of the cost of acquiring tourists, the gradual decline of the profitability of tourism development, and the marginal promotion effect of poverty alleviation.

According to the results of dynamic VAR model and impulse response model, there is a certain lag between tourism development level and poverty alleviation in the short term, but tourism development always has a positive promoting effect on poverty alleviation in the long run. In addition, Granger causality test results show that tourism development and poverty alleviation have a two-way causal relationship. All of the above factors indicate that there is a certain circular mechanism between tourism development, that is, if there is a virtuous cycle, on the one hand, tourism development can increase employment opportunities, promote economic development, make residents benefit from it and alleviate poverty; on the other hand, according to the theory of social exchange, residents benefit more from tourism, and their own attitude toward tourism tends to be positive. More willing to put labor capital into the tourism industry,

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expand the scale of tourism, improve the level of tourism development. Therefore, the relationship between tourism development and poverty alleviation is relative. Whether tourism development promotes poverty alleviation depends on whether there is a virtuous cycle mechanism between the two. If there is a vicious mechanism, tourism development will also lead to intensified conflicts between local people and local people, widening gap between the rich and the poor, unfair social distribution, and reduced reception efficiency. This is also the reason why previous scholars have obtained completely different results when studying the relationship between tourism development and poverty alleviation.

3.4. Policy suggestions

The government provides skills training to the poverty-stricken people engaged in tourism, constantly improving their comprehensive quality, and at the same time encourages and supports migrant workers, college students and professional and technical personnel to return to their hometowns to develop their own businesses in rural tourism. The simple "tourism poverty alleviation" has been expanded to "knowledge poverty alleviation", "skills poverty alleviation" and "entrepreneurship poverty alleviation", constantly injecting new vitality into the development of rural tourism.

The government should scientifically guide the development of local tourism, adapt to local conditions, formulate an overall poverty alleviation plan for tourism development according to the actual situation of poor villages, vigorously promote leisure agriculture, experience agriculture and other emerging tourism development models, and promote the scientific development of tourism poverty alleviation.

Strengthen planning and management, accelerate the construction of multi-level tourism planning system; Strengthen supervision and assessment, all levels of units to establish a scientific supervision and assessment system, the implementation of the government's poverty alleviation policies, the failure of the personnel to be held accountable; In the different stages of tourism development, the government should intervene scientifically, constantly optimize the structure of financial expenditure, improve the way of financial expenditure.

Further promote industrial integration, strengthen project integration, constantly improve the level of investment in fixed assets, and increase investment in fixed assets. We will make good use of the spillover effect and trickle-down effect of tourism, promote the coordinated development of various industries, and give priority to regional development and comprehensive development projects.

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