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Economic Efficiency Analysis of Tourism Poverty Alleviation in Wuling Mountain Area of Guizhou

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***Abstract*—Tourism poverty alleviation is an important part of poverty alleviation. In order to investigate the performance of tourism poverty alleviation, this paper selected 12 districts in Wuling Mountain Area of Guizhou as research objects, and then built DEA model to measure the total efficiency, pure technical efficiency and scale efficiency of tourism poverty alleviation. The results show that tourism development had a certain effect on economic poverty alleviation and the efficiency of tourism poverty alleviation in Wuling Mountain Area of Guizhou was better than the middle level. However, the tourism poverty alleviation among districts proceed unevenly with some districts lagging behind. Judging from the effect of decomposition efficiency on total efficiency, pure technical efficiency contributed more to total efficiency. Therefore, this paper proposed to establish a training system for tourism practitioners and optimize the management system so as to improve the efficiency of tourism poverty alleviation.**

Keywords—tourism poverty alleviation; DEA; efficiency decomposition; Wuling Mountain Area of Guizhou

I. INTRODUCTION

As a global problem, poverty still hinders the development of the whole society. However, tourism, as a sunrise industry and a green industry, can play a big role in poverty alleviation. The foreign countries have established tourism poverty alleviation system early. In the late 1990s, researchers have tried to connect tourism development with poverty reduction. In 1999, the Department for International Development (DFID) proposed the PPT (Pro-Poor Tourism), which is "tourism for the development of the poor" [1]. Since then, the community has conducted researches on tourism poverty alleviation. In China, tourism poverty alleviation has been promoted as development experience and then more and more domestic scholars have attached great importance to tourism poverty alleviation. For example, Huang Meifang and Yu Chunyu (2014) evaluated the performance of national tourism poverty alleviation in Longsheng County of Guangxi Province according to the analytic hierarchy process, Delphi method and quantitative model method [2]. Feng Weilin and Tao Congchong (2017), based on the sample survey data of poverty-stricken population in Wuling Mountain Area of Chongqing, evaluated quantitatively the performance of tourism poverty alleviation in Southwest China [3]. Huang Yuanji (2017) used DEA to evaluate the performance of tourism poverty alleviation in the Wuling Mountain Area of Hunan [4].

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The previous researches have carried out relevant argumentation and analysis on the economic benefits of tourism poverty alleviation, which provides a sufficient theoretical basis for the research of this paper. However, due to the vast territory of China, some areas have yet to be investigated. The Wuling Mountain Area in Guizhou which is badly poverty-stricken and has abundant tourism resources has been scarcely researched on tourism poverty alleviation efficiency over the years. Therefore, based on the original data of the poor districts of Wuling Mountain Area of Guizhou from 2012 to 2014, this paper used the DEA model to make evaluations on the economic benefits of tourism poverty alleviation in the region, and proposed corresponding policy recommendations.

II. RESEARCH DESIGN

A. Research methods

DEA (Data Envelope Analysis) is mainly used to calculate the relative effectiveness of homogeneous decision-making units (DMU) converting multiple inputs into multiple outputs by comparing the degree that the decision-making units deviate from the frontier [5]. It is equivalent to the Pareto efficiency (or non-dominated solution) of the multi-objective programming problem. According to the basic principle of DEA, the efficiency of tourism poverty alleviation should take the district as the actual decision-making unit to research the driving roll of tourism to economy.

DEA can be assorted into two categories according to the scale returns. One is the CCR model under the constant returns to scale (CRS) and the other is the BCC model with the variable return to scale (VRS) [6]. The CCR model mainly measures the total efficiency of the decision-making unit. The total efficiency can be decomposed into scale efficiency and pure technical efficiency. Both scale efficiency and pure technical efficiency can be measured by the BCC model. The expressions of the CCR model and the BCC model are as follows:

CCR model

$$\begin{cases} min\theta \ \ \theta \text{ unlimited} \\ s.t.\sum_{j=1}^{n}\lambda x_{ij} + S_I^- = \theta x_{i0} \\ \sum_{j=1}^{n}\lambda_j y_{rj} - S_r^+ = y_{r0} \\ S_I^- \geq 0,\ \ S_r^+ \geq 0,\ \ \lambda_j \geq 0, j = 1,2,\dots,n \end{cases} \quad (1)$$

BCC model

$$\begin{cases} min\theta \quad \theta \text{ unlimited} \\ s.t.\sum_{j=1}^{n}\lambda x_{ij} + S_I^- = \theta x_{i0} \\ \sum_{j=1}^{n}\lambda_j y_{rj} - S_r^+ = y_{r0} \\ \sum_{j=1}^{n}\lambda_j = 1 \\ S_I^- \geq 0,\ S_r^+ \geq 0,\ \lambda_j \geq 0, j = 1,2,\dots,n \end{cases} \quad (2)$$

In equations (1) and (2), x_{ij} represents the total amount of the ith input of the jth DMU, and y_{rj} represents the total output of the rth type of the jth DMU. θ is the total efficiency of the target DMU. λ_j is the weight variable. S_I^- or S_r^+ is the slack variable of input or output. If the optimal solution is that $\theta^* = 1$ and $S_I^- = S_r^+ = 0$, the DMU is DEA efficient, indicating that the efficiency of resource distribution is optimized to the best. If the optimal solution is that $\theta^* = 1$, the DMU has weak DEA efficiency. If the optimal solution is that $\theta^* < 1$, the DMU is not DEA efficient.

B. Object selection

This paper takes the Wuling Mountain Area of Guizhou as the research object and selects 12 districts which have tourist attractions of Grade 3A or above as the DMU because these attractions have better construction and more convenient transportation. Tourism in these districts play an important role in the development of economy. The selected districts and scenic spots are listed in Table 1.

TABLE I. DISTRICTS AND REPRESENTATIVE SCENIC SPOTS

City	Ddistrict	Tourist attractions of Grade 3A or above
Tongren	Shiqian	Wude-the Land of Peach Blossoms, The Ancient Upstairs Village, Fodingshan Mountain
	Bijiang	Ming Paradise
	Sinan	Haojiawan Tourist site, Tenglong Gorge, Thermal spring& stone forest scenic spot
	Wanshan	Wanshan Mine Park
	Songtao	Guizhou Miao Wangcheng
	Yuping	Pingshan Mountain, Camellia Spring
	Jiangkou	Fish and grain agricultural park, Zhaisha Dongzhai, Mountain Fanjing, Yamu Gou, Yun She
	Dejiang	Gaojia Wan high efficiency agriculture scenic spot
	Yanhe	Nanzhuang
	Yinjiang	Tuanlong
Zunyi	Wuchuan	HongDu River, Ge Lao Culture Tourist site
	Meitan	Sea of Teas Ecological Park, "One in the world pot" Tea Culture park

C. Establishment of indicator system

The tourism poverty alleviation aims to improve local economy through the development of tourism, and thus improve the living conditions of residents. As for the output indicator system, the per capita disposable income of urban residents and the per capita net income of farmers are selected as the income reflects the living standard of the residents. As for the input indicator system, indicators that can show the degree of tourism development should be selected. The comprehensive tourism income can reflect the achievements of the tourism industry, and the number of tourist can reflect the attractiveness of the region. Therefore, the input indicator system is constituted by the per capita tourism comprehensive income and per capita tourist receptions, because of the need to balance the input indicators with the output indicators. The original data of 12 districts of Wuling Mountain Area of Guizhou Province from 2013 to 2016 comes from the statistical communique of the national economic and social development, the Report on the Work of the Government and *Guizhou Statistical Yearbook*. In this study, the number of DMUs is 12, and the number of indicators is 4, which meets the requirement of DEA model that the number of DMUs is supposed to be more than twice the number of indicators.

III. EMPIRICAL ANALYSIS

A. Total efficiency analysis

Based on the DEC-CCR model, the tourism poverty alleviation efficiency of districts in Wuling Mountain Area of Guizhou from 2013 to 2016 was calculated by deap2.1. The results are shown in Table 2.

TABLE II. TOTAL EFFICIENCY OF TOURISM POVERTY ALLEVIATION IN WULING MOUNTAIN AREA OF GUIZHOU

District	2013	2014	2015	2016	Mean
Shiqian	0.449	0.404	0.413	0.437	0.426
Bijiang	0.305	0.294	0.287	0.318	0.301
Sinan	0.682	0.680	0.663	0.657	0.671
Wanshan	1.000	1.000	1.000	1.000	1.000
Songtao	0.614	0.568	0.581	0.591	0.589
Yuping	0.269	0.318	0.292	0.324	0.301
Jiangkou	0.139	0.117	0.125	0.152	0.133
Dejiang	1.000	1.000	1.000	1.000	1.000
Yanhe	0.574	0.539	0.550	0.539	0.551
Yinjiang	0.350	0.328	0.331	0.357	0.342
Wuchuan	1.000	1.000	1.000	1.000	1.000
Meitan	0.921	1.000	0.982	0.968	0.968
Mean	0.609	0.604	0.602	0.612	0.607

Overall, the total efficiency of tourism poverty alleviation in the Wuling Mountain Area of Guizhou was 0.607, better than the average. From 2013 to 2016, it at first declined but rose afterward. This was a process of exploration where the allocation of resources became better later, which was inseparable from the local governments' full understanding of tourism resources in all areas. However, the overall efficiency of tourism poverty alleviation was uneven among different regions. Jiangkou had the lowest total poverty alleviation efficiency in tourism every year, and its average efficiency in the past 4 years was only 0.133. By contrast, Wanshan, Dejiang and Wuchuan had gained DEA effectiveness for 4 successive years. Due to the differences in tourism resources in different regions, the effect of tourism on poverty alleviation varied. In addition, the tourism poverty alleviation work in Wuling Mountain Area of Guizhou needs improvement as the total efficiency of tourism poverty alleviation in Shiqian,

Bijiang, Songtao, Yuping, Jiangkou and Yanhe was lower than the average level of Wuling Mountain Areas in Guizhou.

B. Decomposition efficiency analysis

The total efficiency can be decomposed into two parts: pure technical efficiency and scale efficiency. Pure technical efficiency and scale efficiency are interrelated to each other but jointly contribute to total efficiency. Based on the DEA-BCC model, the pure technical efficiency and the scale efficiency can be calculated by using the deap2.1.

1) Pure technical efficiency analysis

Pure technical efficiency measure depicts the distance between the actual production point and the production possibility curve under the assumption of optimal production scale, which caused by system and management. It mainly reflects whether the way of tourism poverty alleviation is reasonable. If the pure technical efficiency is equal to 1, it means that with the current technical level, the allocation of tourism resources is reasonable and will have certain good effects on poverty alleviation. The evaluation of the pure technical efficiency of tourism poverty alleviation in Wuling Mountain Area of Guizhou is shown in Table 3.

TABLE III. PURE TECHNICAL EFFICIENCY OF TOURISM POVERTY ALLEVIATION IN WULING MOUNTAIN AREA OF GUIZHOU

District	2013	2014	2015	2016	Mean
Shiqian	0.471	0.412	0.426	0.447	0.439
Bijiang	1.000	1.000	1.000	1.000	1.000
Sinan	0.695	0.694	0.686	0.671	0.687
Wanshan	1.000	1.000	1.000	1.000	1.000
Songtao	0.625	0.586	0.604	0.606	0.605
Yuping	1.000	1.000	1.000	1.000	1.000
Jiangkou	0.147	0.118	0.127	0.154	0.137
Dejiang	1.000	1.000	1.000	1.000	1.000
Yanhe	0.588	0.546	0.569	0.553	0.564
Yinjiang	0.361	0.339	0.347	0.371	0.355
Wuchuan	1.000	1.000	1.000	1.000	1.000
Meitan	1.000	1.000	1.000	1.000	1.000
Mean	0.741	0.725	0.730	0.734	0.732

It can be seen from Table 3 that the average of pure technical efficiency of tourism poverty alleviation in Wuling Mountain Area of Guizhou from 2013 to 2016 was 0.732, which was at an upper-middle level. Overall, the methods of tourism poverty alleviation there was reasonable, and its system and management were effective. However, the annual average pure technical efficiencies of tourism poverty alleviation in the Wuling Mountain Area of Guizhou were in a state of flux, indicating that the local tourism poverty alleviation was significantly affected by the system and management. Bijiang, Wanshan, Yuping, Dejiang, Wuchuan and Meitan had been purely technically effective for four successive years, indicating that at the current level of technology, these regions had reasonable tourism resources configuration. The pure technical efficiency of Shiqi, Jiangkou and Yinjiang were below 0.5, indicating that the technology promotion in these areas was inadequate and poor. Combined with the results in Table 2, the total efficiency of tourism poverty alleviation in Bijiang, Yuping and Meitan were DEA ineffective, but the pure technical efficiency there was effective. It may be said that the scale of investment in tourism resources in these areas were not optimal.

1) Scale efficiency analysis

Scale efficiency refers to the gap between the current scale and the optimal one under certain conditions, reflecting the efficiency of the scale of tourism on economic poverty alleviation. Increasing returns to scale means that the proportion of increase in output is greater than that of the increase in input, indicating that the investment in tourism is insufficient, and scaling up can increase productivity. Conversely, declining returns to scale means that tourism investment is redundant, and scaling down can increase productivity. When the scale efficiency is equal to 1, the scale return is unchanged, indicating that the factor input of tourism poverty alleviation has reached the optimal scale. The evaluation of the scale of tourism poverty alleviation in the Wuling Mountain Area of Guizhou is shown in Table 4.

TABLE IV. SCALE EFFICIENCY OF TOURISM POVERTY ALLEVIATION IN WULING MOUNTAIN AREA OF GUIZHOU

District	2013		2014		2015		2016	
	Scale efficiency	*Return to scale*	*Scale efficiency*	*Return to scale*	*Scale efficiency*	*Return to scale*	*Scale efficiency*	*Return to scale*
Shiqian	0.954	drs	0.981	irs	0.969	irs	0.977	irs
Bijiang	0.305	drs	0.294	drs	0.287	drs	0.318	drs
Sinan	0.981	drs	0.979	irs	0.968	irs	0.979	irs
Wanshan	1.000	-	1.000	-	1.000	-	1.000	-
Songtao	0.983	drs	0.969	irs	0.962	irs	0.976	irs
Yuping	0.269	drs	0.318	drs	0.292	drs	0.324	drs
Jiangkou	0.942	drs	0.995	irs	0.982	irs	0.988	irs
Dejiang	1.000	-	1.000	-	1.000	-	1.000	-
Yanhe	0.976	drs	0.989	irs	0.966	irs	0.973	irs
Yinjiang	0.970	drs	0.966	irs	0.955	irs	0.962	irs
Wuchuan	1.000	-	1.000	-	1.000	-	1.000	-
Meitan	0.921	drs	1.000	-	0.982	drs	0.968	drs
Mean	0.858		0.874		0.864		0.872	

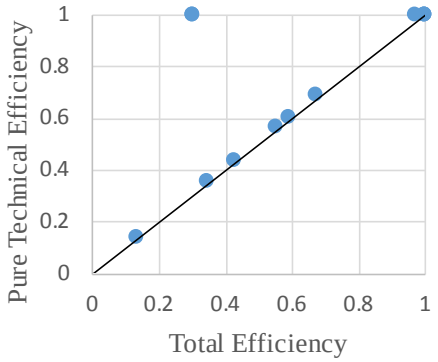
Note: "irs" stands for increasing returns to scale; "drs" stands for decreasing returns to scale, "-" stands for unchanged returns to scale

It can be seen from Table 4 that the average scale efficiency of tourism poverty alleviation in the Wuling Mountain Area of Guizhou from 2013 to 2016 was 0.867, which was at an upper-middle level. The annual averages were 0.858, 0.874, 0.864 and 0.872, respectively, which was relatively stable with little change. The scale efficiency of some districts (Wanshan, Dejiang, Wuchuan) had been in the same stage of constant returns to scale, indicating there had optimum the scale of development of local tourism and the reasonable proportion of factor inputs. The scale efficiency of several districts (Shiqian,

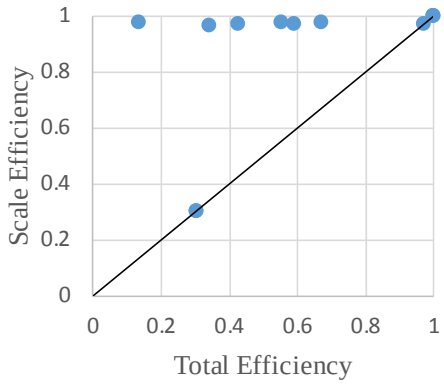
Sinan, Songtao, Jiangkou, Yanhe, Yinjiang) were in the increasing stage of scale returns, indicating that the development of tourism in these areas had a significant effect on economic poverty alleviation. But the scale of tourism development in these areas still has room for further expansion. If expand investment in tourism resources, the efficiency of tourism poverty alleviation can be improved. Bijiang and Yuping had reducing returns to scale, indicating that there was redundancy in tourism investment in these two places. Excessive expansion of tourism scale did not play an important part in poverty alleviation. Therefore, tourism resources can be appropriately reduced to save costs.

2) The relationship between total efficiency and pure technical efficiency and scale efficiency

According to the mean value of total efficiency, pure technical efficiency and scale efficiency of tourism poverty alleviation in Wuling Mountain Area of Guizhou from 2013 to 2016, a scatter diagram of total efficiency and pure technical efficiency and a scatter diagram of total efficiency and scale efficiency are produced respectively (Fig. 1). They can reflect the contribution of decomposition efficiency to total efficiency.



(a) Total efficiency— Pure technical efficiency



(b) Total efficiency— Scale efficiency

Fig. 1. Scatter diagrams of total efficiency and pure technical efficiency, total efficiency and scale efficiency

In Fig. 1, the abscissas are the total efficiency, and the ordinates are pure technical efficiency and scale efficiency, respectively. In general, the dot is closer to the diagonal, the efficiency has more contribution to the overall efficiency. It can be seen from diagrams (a) and (b) that the scatter dots of tourism poverty alleviation efficiency are not completely matched with the 45-degree diagonal, so the total efficiency of tourism poverty alleviation was affected by purely technical and scale efficiency. In diagram (a), most of the scatters are near the 45-degree diagonal. While in diagram (b), only a small number of scatters are on the 45-degree diagonal, and other scatters are at the top of the scatter plot. These phenomena are consistent with the result that the overall mean of scale efficiency was greater than that of pure technical efficiency. Therefore, pure technical efficiency contributed more to total efficiency than scale efficiency. If we want to improve the efficiency of tourism poverty alleviation, we should focus on enhancing the pure technical efficiency, increase the technical promotion of tourism and improve systems and management.

IV. Conclusion and Suggestion

A. Conclusion

This paper uses the DEA model to measure the tourism poverty alleviation efficiency of 12 districts in Wuling Mountain Area of Guizhou from 2013 to 2016. From the total efficiency, pure technical efficiency and scale efficiency, the following conclusions can be drawn.

Firstly, the average efficiency of tourism poverty alleviation in the Wuling Mountain Area of Guizhou from 2013 to 2016 was 0.607, which was at an upper-middle level. However, due to the differences in tourism resources in various regions, the overall efficiency of tourism poverty alleviation was unevenly distributed, and the total efficiency of every district differed a lot. Among them, Wanshan, Dejiang and Wuchuan had higher total efficiency of tourism poverty alleviation, and all of them are effective in DEA. Wanshan actively explored the “tourism+” model, focusing on the cultural tourism industry, and enjoyed the support of the State Council's policy for resource-exhausted city. Dejiang’s “Nuo Culture” attracted countless tourists from home and abroad, and Fengxiangxi Conference site and other “Red Culture” made Dejiang become a popular red tourist destination. Wuchuan was the only well-preserved Gelao ethnic culture village in the country, which increased tourism appeal by its unique culture. Therefore, the development of tourism in these areas has greatly contributed to the poverty alleviation. Jiangkou had the lowest efficiency of tourism poverty alleviation because tourism poverty alleviation there started earlier than that in other districts. The tourism poverty alleviation stagnated so its effect was not as good as that of other districts where tourism poverty alleviation just begun.

Secondly, the average pure technical efficiency was 0.732, and the average scale efficiency was 0.867. They were above average. All these good achievements were due to the efforts of promoting poverty alleviation in tourism and expanding the scale of the tourism industry by Guizhou Province. However, returns to scale of Yuping and other places were on the decreasing, showing that the local tourism-related resources were improperly utilized and there was redundancy in investments. Blindly expanding the scale of tourism has not fueled the economic poverty alleviation. From the contribution of decomposition efficiency to total efficiency, total efficiency was more constrained by pure technical efficiency. The pure technical efficiency was generally lower than the scale

efficiency and the low pure technical efficiency was the main reason for the poor performance of the total efficiency, therefore, improving the pure technical efficiency is the key to improving the efficiency of tourism poverty alleviation.

B. Suggestion

On the one hand, establish a training system for tourism practitioners. Due to the constraints of resources and conditions, governments in poverty-stricken areas often overlook the personnel training mechanism, the employees do not have a good education and professional quality. As an important part of the modern service industry, tourism has high requirements for the service awareness, reception capacity and tourism common sense of relevant practitioners. Most of the rural tourism workers are farmers with lower education levels, which restrict the development of local tourism to a certain extent. Therefore, local governments should establish effective personnel training mechanism, popularize local cultural common sense, and enhance residents' participation in tourism poverty alleviation. They could also conduct professional training for tourism practitioners on service awareness and reception capacity so as to comprehensively improve the utilization rate of talents and promote the tourism poverty alleviation.

On the other hand, optimize the management system. Wuling Mountain Area of Guizhou boasts rich tourism resources and has good basic conditions for tourism poverty alleviation. Therefore, the utilization efficiency of these resources has become a critical issue. From the empirical results of this paper, the efficiency of tourism poverty alleviation in Wuling Mountain Area of Guizhou mainly depends on the pure technical efficiency. However, Yinjiang and other districts had relatively low pure technical efficiency. Therefore, local governments should perfect the management system and increase the utilization efficiency of tourism investment. The following are specific measures which can be considered. First, make detailed plans for tourism poverty alleviation in accordance with the type of tourism resources in the jurisdiction to avoid homogenization competition. Second, clarify the responsibility and division of labor for each department to avoid the duplication or omission of work content. Third, supervise the tourism development market, securing both the economic benefits and the social benefits of tourism poverty alleviation, and avoiding the loss of long-term interest by blind developed tourism projects.

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