Tourism Management and Technology Economy (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/tmte.2023.060103
ISSN 2616-2199 Vol. 6 Num. 1

Evaluation and Influencing Factors Analysis of Urban Tourism Efficiency in Taihang Mountain Region

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Keywords: Tourism Dfficiency, Taihang Mountain Region, Influencing Factors

Abstract: The level of tourism efficiency directly affects the level of tourism industry quality, to improve tourism efficiency is an important measure to achieve quality upgrading of tourism. With the Taihang Mountain region as the research object and 18 cities within the region as the decision-making unit, the tourism efficiency of the region during 2016-2020 was comprehensively measured based on the DEA-Malmquist index model, and the influencing factors were analyzed. The results show that: (1) From 2016 to 2020, the comprehensive tourism efficiency of Taihang Mountain region shows a general trend of fluctuation, and the development level of tourism development of each city is uneven. (2) The total factor production efficiency of regional tourism showed an obvious downward trend from 2016 to 2020, mainly due to limited investment scale and no obvious progress in technology; The index of regional total factor production efficiency ranked East Taihang > West Taihang > South Taihang. (3) Industrial structure, transportation convenience and government intervention in tourism economy have significant influences on improving tourism efficiency, while economic development level and scientific and technological innovation level have weak influences.

1. Introduction

Taihang Mountain is an important geographical mountain range with national cultural symbolic significance[1], with good natural ecological environment. It is rich in resources, superior location conditions, and has a good foundation for tourism development, with the advent of the era of mass tourism, as well as major national battles such as the comprehensive construction of a moderately prosperous society in the concentrated contiguous poverty-stricken areas of the Taihang Mountains and the coordinated development of Beijing-Tianjin-Hebei. With a little implementation, the tourism development of Taihang Mountain has ushered in a rare period of historical opportunities, but it is also facing ecological environment protection. The pressure of protection is high, the transformation and upgrading of tourism products is lagging behind, the industrial agglomeration capacity is weak, the transportation system is not perfect, and the new crown lung is not perfect. Challenges such as the inflammatory epidemic[1]. In this context, scientific and objective evaluation of tourism efficiency and analysis in the Taihang Mountain area. The study of its influencing factors can strengthen the efficiency of tourism resource allocation in the Taihang Mountain region and promote the quality of the tourism industry level, cultivate new momentum of regional economic

and social development and characteristic advantageous pillar industries, and promote the revitalization of rural areas in Taihangshan, it is of great significance to achieve high-quality development.

Efficiency, which refers to the efficient allocation of resources, is an economic conception[2]. Tourism efficiency is an important basis for measuring whether the utilization of regional tourism resources is reasonable and the level of tourism development[3]. The research on tourism efficiency began earlier abroad, mostly focusing on core tourism departments such as hotels[4], travel agencies[5], scenic spots[6], tourism transportation[7], etc.in China

The research started relatively late, focusing on efficiency estimation[8], spatial evolution[9], influencing factors[10], coupling analysis[11] and so on. Among them, the research perspective of destination efficiency evaluation mainly focuses on different spatial scales such as the whole country[12], economic belt[13], urban agglomeration[14], province[15][15] and excellent tourism city[16], especially focusing on typical areas such as the Yangtze River Basin[17], the Yellow River Basin[18][18], and border areas[19]. With the change of social concerns, the research topics gradually shift from the tourism economic efficiency of destinations[20] to tourism environmental efficiency[21], tourism ecological efficiency[22], tourism internal and external circulation efficiency[23] and other aspects. The estimation methods are also constantly being optimized, mainly using the traditional DEA model[24] and stochastic frontier analysis (SFA)[25] to improve the DEA[26] and Super-SBM model[27] and other research methods. In the study of the influencing factors of tourism efficiency, convergence analysis[28], modified gravity model[29], multiple regression model[10], generalized (SYS-GMM) moment model[30], impulse response function[31] and other methods are used to organize the hair. At present, scholars believe that tourism efficiency is mainly affected by various factors such as geographical spatial proximity, industrial structure, economic development level, transportation location, and government intervention[32][33].

With the development of the tourism industry, relevant research is also constantly enriched, but the existing research rarely covers mountain areas such as the Taihang Mountains. In view of this, the Taihang Mountain area was selected as the research object, and the improved DEA model (DEA-Malmquist index model) was used to comprehensively evaluate the tourism efficiency of the region from 2016 to 2020, and the tourism efficiency characteristics of the cities in the Taihang Mountain area were deeply studied, and the influencing factors were carried out with the help of SPSS25.0 software. Regression analysis was carried out in order to provide reference for the quality and upgrading of tourism industry in Taihangshan region.

2. Research Methods and Research Objects

2.1 Research Methods

2.1.1 DEA-BBC Model

The data envelopment analysis (DEA) method is a more commonly used efficiency evaluation method, which has the advantage that it can process different types of data without considering the specific production function, without pre-estimating parameters and weights[34], which is especially suitable for efficiency evaluation of multi-input and multi-output types. DEA mainly has two models, CCR and BBC, BBC based on the CCR model, the model introduces variable scale remuneration, which further subdivides the comprehensive efficiency of the decision-making unit into pure technical efficiency and scale efficiency, in which pure technical efficiency is the degree to which the decision-making unit exerts its own technical level in the process of tourism industry development, and scale efficiency is the regional tourism efficiency that measures the impact of scale factors[18]. Based on this model, the relative efficiency of tourism industry development during

2016-2020 is evaluated. The formula is (1):

$$\begin{cases} \min\theta \\ \sum_{j=1}^{n} X_j \lambda_j + S^- = \theta X_0 \\ \sum_{j=1}^{n} Y_j \lambda_j - S^+ = Y_0 \\ \sum_{j=1}^{n} \lambda_j = 1 \\ \lambda_j \geq 0,\ S^- \geq 0; S^+ \geq 0,\ j=1, 2, \ldots, n \end{cases} \quad (1)$$

Where, θ represents the efficiency value of decision making unit, j= 1, 2... X_j, Y_j are input and output vectors respectively. λ_j represents the weight coefficient, S^- and S^+ are the residual variable and the slack variable respectively, reflecting the output shortage and input redundancy of the decision-making unit. In the above equations, DEA is effective when θ =1, $S^-=S^+=0$; When $\theta=1$, $S^- \neq 0$ or $S^+ \neq 0= 1$, the weak DEA is effective. When $\theta < 1$, decision making unit was not effective in DEA[35].

2.1.2 DEA-Malmquist Methods

The DEA model can only perform static efficiency analysis on the decision unit, and cannot well reflect the dynamic change of the decision unit within a certain time range. The Malmquist exponential model dynamically measures the total factor efficiency index of the decision unit after adding time factors by defining the ratio of the input distance function and the output distance function changes[36]. The DEA-Malmquist model breaks down the total factor productivity index into technological efficiency variations Effch and Techch[37], under the condition of variable return to scale, the change of technical efficiency can be further divided into pure technical efficiency and scale efficiency to make it suitable for dynamic efficiency measurement in various fields, the formula is:

$$TFP=EFFCH \times TECH=EFFCH \times PTECH \times SECH \quad (2)$$

That is, malmquist index=technological progress × overall efficiency = technological progress × pure technical efficiency × scale efficiency, when TFP >1, it indicates that tourism efficiency increases, and vice versa; When PE, SE and TE are greater than 1, they indicate pure technical efficiency, scale efficiency improvement and existing technical contribution, respectively, otherwise, it decreases.

2.2 Research object selection

According to the Taihang Mountain Tourism Development Plan (2020-2035), the study involves 18 cities (Table1), each of which is regarded as a separate decision-making unit.

Table 1: List of Cities in the Taihang Mountains Area

Area	Province	City
East Taihang Mountains	Beijing	Beijing
	Hebei	Handan, Xingtai, Shijiazhuang, Baoding, Zhangjiakou
West Taihang Mountains	Shanxi	Taiyuan, Datong, Yangquan, Xinzhou, Jinzhong
South Taihang Mountains	Shanxi	Jincheng, Changzhi
	Henan	Anyang, Hebi, Xinxiang, Jiaozuo, Jiyuan

Note: The table is organized by the author according to "Taihang Mountain Tourism Development Plan (2020-2035)".

3. Indicator selection and data sources

3.1 Index selection

3.1.1 Evaluation efficiency index

Efficiency calculations are based on industry input and output data. Considering the comprehensiveness and high correlation of the tourism industry, and the rule that the effective operation of the DEA model requires that the number of decision-making units be greater than the sum of the number of input and output indicators, on the basis of existing research, in line with the objectivity of data, representativeness, availability and other principles, drawing on previous studies, selected the following input indicators and output indicators (Table 2).

Input indicators: ①labor force, the tourism industry is a labor-intensive industry, and labor input directly affects the efficiency of regional tourism. Considering the relevance of the tourism industry and the lack of special data, and in order to better measure the overall development of the industry, choose the first the ratio of the number of employees in the tertiary industry to the number of social employees is used as an indicator of labor input. ②Capital, capital investment is also an important factor affecting the efficiency of the regional tourism industry. Tourism fixed asset investment is the index that can best reflect the capital investment of the tourism industry, but there is no such data in the existing statistical data. Considering that the tourism industry is a the comprehensive industry has a strong industrial correlation, so the ratio of the fixed asset investment of the tertiary industry to the fixed asset investment of the whole society is selected as the specific capital variable. ③ Tourism resources, resources are the foundation of the development of the tourism industry, and their abundance directly determines the extent of regional tourism development in the future. This paper selects the number of A-level scenic spots in each city as the resource input index.

Output indicators: Select two indicators that can most directly reflect the development of the tourism industry, that is, the total number of tourist receptions and comprehensive tourism income as the specific indicators of social output and economic output respectively.

Table 2: Tourism Efficiency Evaluation Undex System

Indicator type	Level 1 indicators	Level 2 indicators
input	Labor input	The ratio of employees in the tertiary industry to social employees
	Capital investment	The ratio of investment in fixed assets in the tertiary industry to the investment in fixed assets in the whole society
	Investment in tourism resources	Number of A-level scenic spots (pieces)
output	Social output	Total Tourist Reception (10, 000 person-times)
	Economic output	Comprehensive income from tourism

3.1.2 Selection of Influencing Factors

In order to further study the influencing factors affecting the tourism efficiency of cities in the Taihang Mountains region, referring to previous studies, the comprehensive efficiency of tourism in each city is chosen as the dependent variable, and the industrial structure, transportation convenience, government intervention, economic development level and technological innovation level are five factors. Indicator as an independent variable. Among them, the industrial structure is reflected by the proportion of the output value of the tertiary industry in the total output value, the

convenience of transportation is reflected by the mileage of regional highways, the degree of intervention of the local government is reflected by the ratio of regional government fiscal expenditure to local GDP, and the per capita GDP of the region is used It reflects the level of economic development, and reflects the degree of scientific and technological innovation by the ratio of regional science and technology expenditure to total government expenditure.

3.2 Data source

All the above data are from the 2017-2021 “China Urban Statistical Yearbook”, “Henan Statistical Yearbook”, “Hebei Statistical Yearbook”, “Shanxi Statistical Yearbook” and the Statistical Yearbook of each city, as well as the Statistical Bulletin of National Economic and Social Development of each city from 2016 to 2020.

4. Empirical analysis

4.1 Static Analysis of Tourism Efficiency Based On DEA-BBC Model

Based on the data of 18 cities in the Taihang Mountain area from 2016 to 2020, the regional tourism development efficiency value is measured with the help of DEAP2.1 software, and the specific analysis is as follows.

4.1.1 Overall Efficiency Analysis

Based on the data of 18 cities in the Taihang Mountains region from 2016 to 2020, the development efficiency of regional tourism is calculated with the help of DEAP2.1 software. The specific analysis is as follows:

(1) Comprehensive efficiency analysis

From 2016 to 2020, the comprehensive tourism efficiency in the Taihang Mountains region fluctuated as a whole (Figure 1), with an average value of 0.76 during the period, indicating that the actual output only accounted for 76% of the ideal output, and the overall development level is average, and there is a large room for improvement. Among them, the continuous rise in 2016-2017 and 2019-2020 is closely related to the concept of supply-side structural reform, global tourism and other concepts proposed by the country at the same time and the prosperity and development of rural tourism.

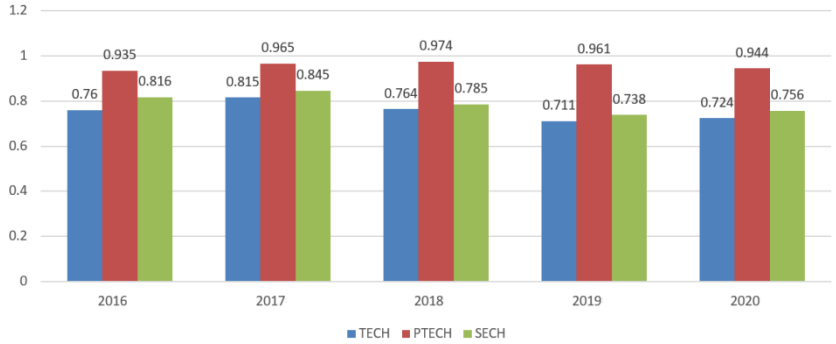

Figure 1: Average Tourism Efficiency of Taihang Mountain Area from 2016 to 2020

From the perspective of each city (Table 3), the only city with effective comprehensive tourism efficiency in the Taihang Mountains region from 2016 to 2020 is Beijing; the cities with higher comprehensive efficiency than the average include Beijing, Shijiazhuang, Handan, Baoding, Taiyuan, Datong, Jinzhong, Xinzhou, Changzhi, Jincheng, Anyang, and Jiaozuo are 12 cities,

accounting for 66.66% of the total; 8 cities are below the average value, accounting for 44.44% of the total. From the perspective of each region (Table3), the overall development trend of West Taihang is the best, followed by East Taihang, and South Taihang is relatively poor. It can be seen that the tourism development of each city is uneven, and there is a big gap in overall efficiency.

Table 3: Average Tourism Efficiency of Taihang Mountain Area from 2016 to 2020

DMU	tech	ptech	sech	DMU	tech	ptech	sech
Beijing	1.000	1.000	1.000	Changzhi	0.888	0.991	0.896
Shijiazhuang	0.999	1.000	0.999	Jincheng	0.923	0.982	0.939
Handan	0.824	0.948	0.872	Anyang	0.739	0.983	0.752
Xingtai	0.476	0.997	0.477	Hebi	0.360	1.000	0.360
Baoding	0.962	0.969	0.992	Xinxiang	0.704	0.978	0.719
Zhangjiakou	0.478	0.631	0.759	Jiaozuo	0.750	0.991	0.755
Taiyuan	0.873	0.901	0.966	Jiyuan	0.290	1.000	0.290
Datong	0.947	0.965	0.978	East Taihang mean	0.790	0.924	0.850
Yangquan	0.701	0.974	0.718	West Taihang mean	0.839	0.947	0.881
Jinzhong	0.864	0.945	0.897	Southern Taihang Mean	0.665	0.989	0.673
Xinzhou	0.809	0.949	0.848	All-region mean	0.710	0.903	0.743

(2) Pure Technical Efficiency and Scale Efficiency

It can be seen from the above that comprehensive efficiency = pure technical efficiency×scale efficiency, and the comprehensive efficiency can be effective only when the optimal allocation of both is achieved. The average efficiency of pure technology in tourism is steadily maintained at a high level, and DEA is effective.The cities are 11 cities in Beijing, Shijiazhuang, Xingtai, Baoding, Yangquan, Jinzhong, Changzhi, Jincheng, Hebi, Jiaozuo and Jiyuan, with 17 cities above the average, accounting for 94.44%. From the perspective of each region, the average value of South Taihang is the highest, followed by West Taihang. The change trend of scale efficiency is basically consistent with the change trend of comprehensive efficiency, which is relatively small compared with the value of pure technical efficiency. It can be seen that the level of comprehensive efficiency in the Taihang Mountains region depends on the level of scale efficiency.

In order to further demonstrate the impact of changes in pure technical efficiency and scale efficiency on comprehensive efficiency, and to analyze the differences in tourism efficiency of various cities in each year more intuitively, drawing on the research of Liu Wei[38] and Song Mingzhen[39], the coordinate axis was established, pure technical efficiency was the horizontal axis, scale efficiency was the vertical axis, and the average value was the zero cut-off point, and the tourism efficiency of each city from 2016 to 2020 was divided into high-high (high technical efficiency-high scale efficiency), high-low (high technical efficiency-low scale efficiency), The classification results of the four types of low-high (low technical efficiency - high scale efficiency) and low-low (low technical efficiency - high scale efficiency) are as follows (Table 4).

Table 4: Classification of PTECH and SECH of Tourism in Taihang Mountain Area

	PTECH-High	PTECH-Low
SECH-High	Beijing, Shijiazhuang, Handan, Baoding, Datong, Jinzhong, Xinzhou, Changzhi, Jincheng, Anyang, Jiaozuo	Zhangjiakou, Taiyuan
SECH-Low	Xingtai, Yangquan, Hebi, Xinxiang, Jiyuan	

The results show that the first type of "high-high" pattern includes 11 cities including Beijing, Shijiazhuang, Handan, Baoding, Datong, Jinzhong, Xinzhou, Changzhi, Jincheng, Anyang and Jiaozuo. These cities either rely on good economic and social conditions or rely on rich tourism resources to form brand advantages, and their pure technical efficiency and scale efficiency are higher than the average level. The second type of "high-low" mode has four cities of Xingtai,

Yangquan, Xinxiang, and Jiyuan, and the scale efficiency is lower than the average level. The third type of "low-high" mode is only two cities of Zhangjiakou and Taiyuan, and the pure technical efficiency is lower than Average. The fourth category "Low-Low" mode None. On the whole, the overall tourism efficiency of cities in the Taihang Mountains region is relatively good.

4.2 Dynamic Analysis of Tourism Efficiency Based On DEA-Malmquist Model

The Malmquist index can better reflect the changes in the tourism efficiency of the Taihang Mountains in different periods from a dynamic perspective. Based on the panel data from 2016 to 2020, with the help of DEAP2.1 software, the changes in the total factor productivity index of tourism in this region are calculated and decomposed.

4.2.1 Overall Efficiency Change Analysis

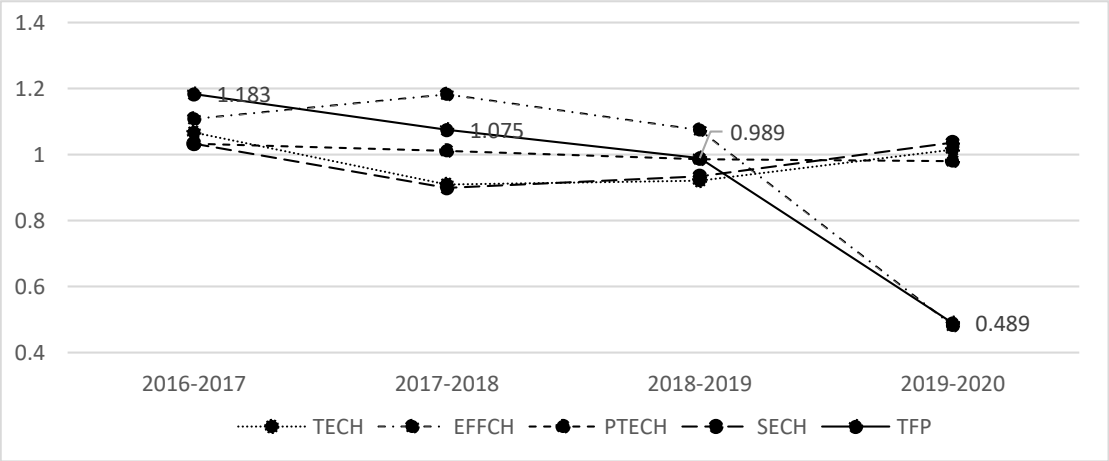

Figure 2: Malmquist Index of Tourism Efficiency in Taihang Mountains and Its Decomposition in 2016-2020

Total factor productivity is an index to measure the growth of production efficiency, which comes from three aspects: efficiency improvement, technological progress and scale effect[40]. The data shows that from 2016 to 2020, the total factor production efficiency of Taihang Mountain tourism showed a significant downward trend, with an average annual decline of -19.82%, indicating that the tourism efficiency in the Taihang Mountain region is constantly declining. From the results of dynamic decomposition, the average annual increase of technical efficiency is 0.88%, the average annual decrease of technological progress efficiency is -18.79%, the average annual decrease of pure technical efficiency is -1.31%, and the average annual increase of scale efficiency is 0.07%. The change trend of progress efficiency and total factor production efficiency is basically consistent, indicating that the tourism technical efficiency in the Taihang Mountains region is greatly affected by the scale of investment. There is a large room for development in supply. From the perspective of the year, the total factor productivity reached its maximum value from 2016 to 2017, and its decomposition efficiency values were all greater than 1. The overall development trend is good. This may be due to the concept of global tourism and the reform of the supply-side structure, which promotes improved tourism efficiency. In 2017-2018, 2018-2019, and 2019-2020, the scale efficiency and technical value increased significantly in these three time periods, but the technological progress efficiency and pure technical efficiency decreased significantly, resulting in a decline in total factor productivity year by year. This may be due to the fact that the country proposed the rural revitalization strategy in 2017, and then promulgated the rural revitalization strategic plan, specifying that the tourism industry is an important pillar industry to promote rural

development. The scale of the tourism industry has expanded, but the corresponding management level and technical level have not achieved synchronous growth, and even experienced negative growth, which has inhibited the growth of total factor productivity.

4.2.2 Regional Efficiency Change Analysis

It can be seen from Figure 3 that the total factor productivity index ranking of each region in the Taihang Mountains from 2016 to 2020 is East Taihang > West Taihang > South Taihang, and the average values are 0.911, 0.879, and 0.823, respectively. The East Taihang region mainly benefits from its advantageous location in the Beijing-Tianjin-Hebei region, and its economic and social development is relatively good. In addition, Xibaipo, Baiyangdian, Wa Palace, Langya Mountain and other scenic spots have a good brand reputation, which promotes the development of tourism economy to a certain scale. , the overall tourism efficiency is higher than other regions. Although the West Taihang and South Taihang areas are rich in tourism resources, there are many well-known scenic spots such as Yungang Grottoes, Pingyao Ancient City, Qiao Family Courtyard, Wutai Mountain, Yuntai Mountain, Hongqi Canal, Linzhou Taihang Grand Canyon, Huangcheng Xiangfu, etc. However, compared with East Taihang, it has insufficient advantages in terms of geographical location and economic and social development level, as well as insufficient development scale and technical level, resulting in a certain gap with other regions. Therefore, while maintaining the advantages of regional scale, West Taihang should improve its management level and service quality; while both East Taihang and South Taihang should strengthen management and improve technology, they should focus on resource input and allocation to achieve scale optimization.

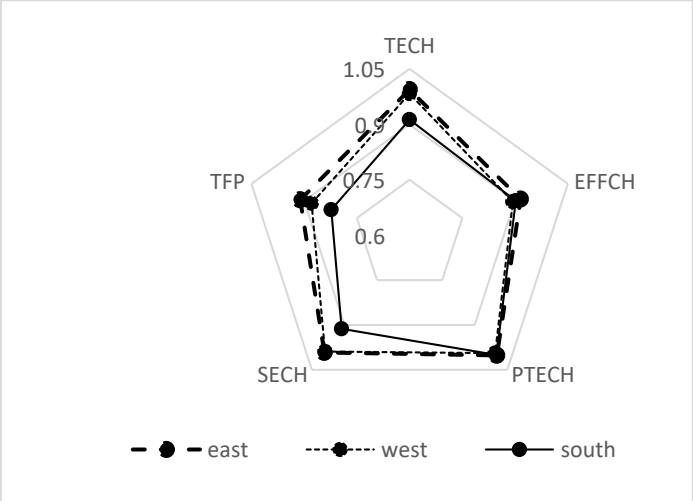

Figure 3: Malmquist Index Decomposition of Various Regions of Taihang Mountain from 2016 to 2020

4.2.3 Analysis of Efficiency Changes in Region

In terms of cities (Table 5), tourism efficiency varies significantly, with total factor indices less than 1 for all cities except Xingtai and Xinzhou, indicating that the tourism efficiency of most cities in the Taihangshan region is declining. The technological progress efficiency index of all cities is less than 1, the urban technical efficiency index of 50% is less than 1, and the urban scale efficiency index of 55.56% is less than 1, indicating that regional tourism development is constrained by technological factors and development scale, of which technological progress factors are the main reasons. Among them, although the comprehensive efficiency of Beijing, Shijiazhuang, Jinzhong, Jincheng, Jiaozuo and other cities is higher in the Taihangshan area, due to the development, or

excessive attention to scale expansion, and ignoring technical factors such as service, management, innovation, or the industry has not formed large-scale development, resulting in different degrees of decline in technological progress efficiency, technical efficiency or scale efficiency, so that the Malmquist efficiency index declines. Xingtai and Xinzhou, which have low comprehensive efficiency, have different degrees of increase in decomposition efficiency, which makes the total factor production efficiency index of these two cities relatively high. It can be seen that in the development of tourism, we should pay attention to the scale of industry, service quality, and economy. Balanced development and improvement of business management and technological innovation.

Table 5: Malmquist Index of Tourism Efficiency of Cities in Taihang Mountain Region and Its Decomposition in 2016-2020

	effcht	echch	pech	sech	tfpch
Beijing	1.000	0.885	1.000	1.000	0.885
Shijiazhuang	1.001	0.923	1.000	1.001	0.924
Handan	1.014	0.918	1.042	0.973	0.931
Xingtai	1.167	0.915	1.000	1.167	1.067
Baoding	0.949	0.901	0.959	0.990	0.855
Zhangjiakou	0.866	0.907	1.007	0.860	0.786
Taiyuan	0.931	0.892	0.939	0.991	0.830
Datong	1.080	0.909	1.049	1.030	0.982
Yangquan	0.827	0.901	0.994	0.832	0.745
Jinzhong	0.977	0.894	0.990	0.988	0.873
Xinzhou	1.111	0.916	1.077	1.031	1.017
Changzhi	1.054	0.897	1.000	1.054	0.945
Jincheng	0.953	0.907	0.976	0.976	0.864
Anyang	1.060	0.892	1.007	1.052	0.945
Hebi	0.865	0.916	1.000	0.865	0.792
Xinxiang	1.064	0.934	1.017	1.046	0.994
Jiaozuo	0.826	0.906	0.994	0.831	0.749
Jiyuan	0.910	0.918	1.000	0.910	0.836

4.3 Analysis of Factors Affecting Tourism Efficiency in Taihang Mountains

In order to deeply explore the tourism efficiency of the cities in the Taihang Mountain region, on the basis of the calculation of the comprehensive tourism efficiency of each city, the regression analysis of the influencing factors is carried out with the help of spss software. Before the empirical analysis, multiple linear analysis was carried out on the five selected indicators, and it was found that the variance inflation factor (VIF) of each indicator was much smaller than the critical value of 10, indicating that there was no multicollinearity in the independent variables, and empirical analysis could be carried out.

It can be seen (Table 6) that different independent variable factors have different significance levels on the tourism efficiency of cities in the Taihang Mountains region. Specifically: (1) The industrial structure has a positive impact on regional tourism efficiency at a significance level of 5%, and its impact coefficient is 0.425, that is, the unit contribution rate to the comprehensive efficiency of regional tourism is 0.425 times. There is a coupling and coordinated development between the advanced industrial structure and tourism efficiency[41]. The industrial center is inclined to the tertiary industry, and the industrial structure is gradually improved. The higher the proportion of the tourism industry, the more it can play its relevant and driving role, thereby promoting the improvement of tourism efficiency. (2) The impact of transportation convenience on tourism

efficiency is significant, showing a positive correlation at the level of 5%, with an impact coefficient of 0.3. Transportation is the leading factor among the six elements of traditional tourism and plays an irreplaceable role. From the perspective of the supply side, the improvement of traffic accessibility is conducive to enriching regional tourism resources and improving the supply capacity of tourism resources in various regions to meet the consumption needs of domestic and foreign tourists; from the perspective of demand side, the improvement of traffic accessibility It can reduce the traffic and time costs of tourists, stimulate urban and rural residents to expand tourism consumption expenditure, and fully tap the potential of regional tourism consumption[42]. (3) The degree of government intervention also shows a positive correlation at the level of 5%, with an impact coefficient of 0.349. The tourism industry is a comprehensive and highly correlated industry. Its development and development have a strong dependence on land, capital, and infrastructure. In addition, most of my country's tourism resources have public attributes. The extensive government intervention is the key to the development of China's tourism industry. It is also a major feature of China's tourism industry and an important reason for the rapid development of China's tourism industry. (4) The level of economic development has a positive correlation with the tourism efficiency of cities in the Taihang Mountain region, but it is not significant. The reason for this phenomenon may be that tourism efficiency has a certain competitive relationship with other economies in terms of regional economic development and resource allocation. , indicating that the improvement of regional tourism industry efficiency during the study period did not significantly depend on the level of regional economic development. (5) The degree of scientific and technological innovation has no significant positive correlation with the tourism efficiency of cities in the Taihang Mountains region. This may be related to the fact that the tourism resources of Taihang Mountains are mainly natural landscapes, and the application and promotion of science and technology are relatively low.

Table 6: Regression Results of Influencing Factors Influencing the Comprehensive Efficiency of Urban Tourism Development in the Taihang Mountains Region

Variable	Unnormalized coefficient	Standard error	Standardized coefficient	T	P	Tolerance	VIF
Constant	0.504	0.146		3.451	0.001		
Industrial structure	0.009	0.003	0.425**	2.548	0.013	0.351	2.853
Transportation convenience	0.000	0.000	0.300**	1.988	0.050	0.427	2.340
Degree of government intervention	0.012	0.005	0.349**	2.270	0.026	0.412	2.424
The level of economic development	0.000	0.000	0.169	0.941	0.349	0.302	3.306
Degree of scientific innovation	0.011	0.032	0.065	0.361	0.719	0.300	3.332

Note: a: The dependent variable is the comprehensive tourism efficiency of each city; b: * indicates significance at the 10% level; ** indicates significance at the 5% level.

5. Conclusions and Discussions

5.1 Conclusion

In this paper, the research method combining DEA model and Malmquist index is used to measure and decompose the tourism efficiency of 18 cities in the Taihang Mountain area from 2016 to 2020, and use the SPSS software multiple linear regression model to explore the factors that affect the tourism efficiency of the cities in this area. Conclusion as follows:

(1) From 2016 to 2020, the comprehensive tourism efficiency in the Taihang Mountains area fluctuates as a whole, with a general level of development. The tourism development of each city is uneven. The average comprehensive efficiency is 0.76, and the actual output only accounts for 76% of the ideal output. Cities above the average accounted for 66.66% of the total, and there is a lot of room for improvement. The level of comprehensive efficiency in the Taihang Mountains region depends on the level of scale efficiency, and the change trend of scale efficiency is basically consistent with the change trend of comprehensive efficiency.

(2) From 2016 to 2020, the total factor production efficiency of Taihang Mountain tourism showed an obvious downward trend, with an average annual decrease of -19.82%. From the results of dynamic decomposition, the main reason for the decline of total factor productivity is that technology has not improved significantly, and technical efficiency is greatly affected by the scale of investment, which urgently needs to be improved comprehensively, and there is a large room for development to achieve effective supply through upgrading technology. From the perspective of the year, due to the influence of national policies and situations, the total factor productivity reached its maximum value in 2016-2017, and its decomposition efficiency values were also greater than 1, indicating a good overall development trend. The ranking of the total factor production efficiency index of each region is East Taihang > West Taihang > South Taihang. The East Taihang region mainly benefits from its advantageous location in the Beijing-Tianjin-Hebei region, and its economic and social development is relatively good. Although the West Taihang and South Taihang have abundant tourism. However, due to economic impact, the development scale and technical level still need to continue to improve.

(3) The efficiency of urban tourism in the Taihang Mountain region is affected by many factors. Among them, the industrial structure, transportation convenience factors, and the degree of government intervention in the tourism economy have a significant impact on the improvement of tourism efficiency, while the level of economic development and the degree of technological innovation have a weaker impact on the improvement of red tourism efficiency.

5.2 Discussions

In order to promote the improvement of tourism efficiency in the Taihang Mountain region and promote the high-quality development of tourism in the Taihang Mountain region, based on the previous empirical research, the following suggestions are put forward:

Based on the results of tourism efficiency evaluation, the overall tourism development efficiency of Taihangshan region is average, regional differences are obvious, and the development at this stage has the characteristics of strong resource dependence, regional isolated development and weak industrial agglomeration. Therefore, it is necessary to improve the level of tourism product development and service management in a targeted manner, and expand the tourism economy. Develop the scale and realize the simultaneous development of regional "quality" and "quantity". On the one hand, seize the current development opportunity, strengthen tourism planning, break administrative boundaries, comprehensively strengthen regional tourism cooperation, coordinate high-quality tourism resources, coordinate tourism cooperation in the three major tourism areas of South Taihang, East Taihang and West Taihang, and optimize the allocation and flow of resource elements. On the other hand, taking into account "technology" and "scale", it is necessary to appropriately increase the input of tourism factors and expand, large industrial scale, form scale effect, give play to the agglomeration and driving role of the tourism industry, and pay attention to product development, management level and service quality improvement.

Based on the influencing factors of tourism efficiency, the Taihang Mountain area can improve tourism efficiency by enhancing the force of important influencing factors. First of all, enhance the

industrial support force, comprehensively accelerate the transformation and upgrading of the tourism industry, optimize the industrial structure, and promote the improvement of tourism efficiency; Second, pay attention to the role of the government, strengthen the government's macro-control, fully align with major national strategies, especially increase the government's support in policy, capital, land and talent introduction; Third, improve the transportation network, transform and upgrade tourism transportation, accelerate the completion of inter-provincial and municipal expressways and ordinary national and provincial highways in Taihangshan, and promote the improvement of accessibility in mountainous rural areas and rural road bearing roads; Finally, strengthen the innovation and utilization of science and technology, increase the investment in R&D funds, scientific and technological supporting facilities and scientific research talents, and pay attention to increasing the introduction and utilization of scientific and technological elements in the tourism industry.

This paper improves the DEA model, analyzes the tourism efficiency of Taihangshan region from static and dynamic perspectives respectively, and discusses its influencing factors, which is basically in line with the actual development of tourism industry from the perspective of Taihangshan region. However, there are also some shortcomings: first, affected by the lack of tourism statistics, there are some macro indicators or alternative indicators in the selection of input, output and influencing factor indicators, which will cause a certain degree of deviation in the research results; Second, considering the length of the article, it is not possible to show the spatial evolution of regional tourism efficiency in more detail; Third, considering the vastness of the Taihang Mountain Range, a total of 78 are involved counties (cities), this paper only discusses the perspective of the city, and the refinement of the research content needs to be improved.

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