Research on the Tourism Resource Protection Model and Sustainable Development of Tourism Industry in the Information Age

Fang Gao
Wuhan Business University, Wuhan, China
*Corresponding author e-mail: 12027904@qq.com

Abstract. The protection of tourism resources is an important prerequisite for the sustainable development of the tourism industry, and it is gradually valued by market participants and their government management. This article proposes five tourism resource protection models based on the tourism resource protection subject and tourism product pricing mechanism, and compares and analyzes the tourism resource stocks and social welfare levels under the five tourism resource protection models through numerical simulation methods. Research shows that both private governance and government governance monopoly pricing mechanisms are superior to fully competitive pricing mechanisms, and the proportion of governance funding input or income tax rate decreases with the same level of pollution degradation.

Keywords: Tourism City, Sustainable Development, Protection of Tourism Resources

1. Introduction
How to deal with the relationship between the development and protection of tourism resources is a problem that needs to be constantly explored in the process of sustainable development of tourism. Tourism development and tourism resource protection are contradictory and interdependent. The contradiction is that tourism development will destroy tourism resources to a certain extent, and the mutual dependence is that the development of the tourism industry is inseparable from the protection of tourism resources. Therefore, in order to achieve the sustainable development of the tourism industry, the protection of tourism resources is increasingly valued by market participants and government managers. The research on the development of the tourism industry and the protection of tourism resources in theoretical circles mostly focuses on the issues of enterprise management, separation of ownership and management rights, and tourism development in tourist attractions. Most of the research results are partial and scattered, or given by reference to foreign development experience. The policy recommendations for the development of China's tourism industry lack a scientific and rigorous spirit [1].

2. Theoretical Model Building
Based on the above reasons, this article intends to conduct a comparative study of two protection modes (market-led and government-led) of tourism resources in tourism cities by constructing an
economic model that includes tourism resource protection from the perspective of sustainable development of tourism According to the research conclusions, adaptive countermeasures are given[2,3].

It is assumed that the inverse demand function form of tourism products is the Cobb-Douglas form (for ease of analysis, it is assumed that each tourist consumes one unit of tourism product), the specific form is as follows:

\[ P_t = P_t(Q_t, N_t) = \phi Q_t^\alpha N_t^\beta \]

Among them, \( Q_t \) is the regional t tourism resources, reflecting the quality reflected in the process of tourism consumption (the more tourist resource stocks, the higher the quality of tourism products experienced by individual tourists); \( N_t \) is the number of t tourists, reflecting the degree of tourism crowding It also reflects the demand for tourism products in the tourism market.

At the same time, the objective function set in the dynamic optimal analysis is to maximize social welfare, and it is assumed that the current utility function form reflecting social welfare is: \( U_t(C_t, Q_t) = lnC_t + bInQ_t \), that is, social welfare depends on household consumption And its local natural environment, the natural environment is also expressed in terms of tourism resources.

In addition, assuming that the maximum pollutable amount of regional resources is \( P_{max} \), the actual cumulative pollution in the current period is \( P_t \), the pollution index per visitor is inco; the degradation of pollution includes natural degradation and artificial degradation, and their degradation coefficients are \( deco \) and \((1-deco) \cdot D_t / Y_t \), and the size of the artificial degradation coefficient depends on the proportion of private or government expenditures for pollution control \( D_t / Y_t \), so that this value is equal to \( d_c \). Since the stock of tourism resources is: \( Q_t = P_{max} - P_t \), tourism resources can be obtained. The dynamic equation of the source inventory is as follows:

\[ \dot{Q}_t = [deco + (1-deco) d_c] (P_{max} - Q_t) - inco N_t \]

Combined with the previous definition of the theoretical basis of the model and its related assumptions, in pursuit of the goal of maximizing social welfare, the optimization problem of the basic model can be summarized as:

\[ Max U = \int_{0}^{\infty} (lnC_t + bInQ_t) \cdot e^{-pt} dt \]

\[ s.t. \dot{Q}_t = [deco + (1-deco) d_c] (P_{max} - Q_t) - inco N_t \]

\[ C_t = (1-d_c) \cdot p_t(Q_t, N_t) \cdot N_t \]

3. Tourism Resource Protection Model and Its Dynamic Optimal Analysis

3.1. Connotation and Characteristics of Five Tourism Resource Protection Models

According to the price formation mechanism of tourism products and the main body of resource protection, this article divides the resource protection model into five types.

1) The zero-input model (pattern1 and pattern2) under the market mechanism and government monopoly mechanism can address the situation where tourism pollutants do not have the conditions for artificial treatment (invalid input funds), and its pollution mitigation depends entirely on natural degradation itself; it can also be used as a reference model and The latter three models are compared and analyzed to identify the difference in welfare between non-investment and investment even when there are artificial governance conditions[4,5].

2) Under the market mechanism, the government's centralized governance model (pattern3) is
invested by the government to centrally control pollution. The capital comes from the tax on the private sector, and the tax rate is $d_c$.

3) Private governance model under the market mechanism (Pattern4), the private sector determines the optimal proportion $d^*$ of resource protection from the principle of profit maximization, and the government does not interfere;

4) Government centralized governance model under the government monopoly mechanism (Pattern5), from the perspective of maximizing social welfare, the government is solely responsible for pollution control and resource protection[6,7].

3.2. Optimal Equilibrium Stock of Tourism Resources Under Different Resource Protection Models

Based on the analysis of the connotation and characteristics of the above five resource protection modes, the dynamic optimal analysis of the five resource protection modes under the basic framework of the above model can obtain the optimal equilibrium solution of each variable under different resource protection modes, of which The optimal equilibrium stock of tourism resources under the resource protection mode is not the same (limited to space, only a case of $b = 0.5$ is given), as shown in Figure 1.

Figure 1. Balanced stock of tourism resources under five protection modes ($b = 0.5$)

In Figure 1, the balance of tourism resources in the first two modes under different natural degradation levels is for zero-funding or uncontrollable situations, and the balance of tourism resources in the latter three modes at different natural degradation levels is for private optimal input ratios. Or the situation of the government's optimal income tax rate $d^*$, the following points can be seen from Figure 1.

1) Because tourism resources have the characteristics of public resources, tourism resources are generally in an over-exploited state under the market mechanism. Therefore, if monopoly mechanism pricing is adopted, it will be conducive to the protection of tourism resources. It can be seen from Figure 1 that under the monopoly pricing mechanism, the optimal equilibrium stocks of tourism resources in the two modes of pattern 2 and pattern 5 are higher than those in the other three modes. For pattern 5, when the natural degradation level is greater than 0.33, the government's optimal decision is not to levy environmental pollution fees. At this time, the optimal equilibrium stock of tourism resources tends to be consistent with the pattern 2 situation [8].

2) Comparison of pattern 1, pattern 3 and pattern 4 shows that under the market competition mechanism, the result of private choice of optimal input ratio or government choice of optimal income tax rate is that the optimal equilibrium stock of tourism resources is the same in both patterns 3 and pattern 4. And, at the natural degradation level deco is greater than 0.33 and 0.5 respectively, the tax rate and the optimal input ratio are zero, you can choose not to govern, and completely rely on ecological restoration to maintain the current optimal balanced tourism resource stock (the result is consistent with pattern 1).

3) Comparing pattern 2 and pattern 5, we can see that under the monopoly pricing mechanism, when the natural degradation level is less than 0.33, pattern 2 is more conducive to the protection of tourism resources. To achieve the optimal inventory of tourism resources in the case of pattern 5, the private
sector needs to levy a proportional income tax Used for pollution control.

In general, for the protection of tourism resources, the monopoly pricing mechanism for tourism goods or services is superior to the market pricing mechanism.

3.3. Welfare Analysis under Different Resource Protection Modes
Further, by optimizing the analysis and numerical simulation of the social welfare situation under different resource protection modes, we can get the welfare situation under different natural mitigation levels of pollution, as shown in Figure 2. In order to facilitate comparative analysis, parameter b chooses two situations, respectively 0.5 and 1, reflecting the society's preference for the environment, where the larger the value of b, the higher the society's preference for the environment [9].

It can be seen from Figure 2:
1. The higher the society's preference for the environment, the lower the social maximum welfare level at the same natural degradation level. In addition, as far as the five resource protection models are concerned, under different natural degradation levels of pollution, the social welfare status in pattern 2 is better than pattern 1; the social welfare in pattern 5 is better than pattern 3 and pattern 4.
2. Comparison of pattern 1, pattern 3 and pattern 4 shows that under the market competition mechanism, when the natural degradation coefficient is higher than 0.33, the social welfare in pattern 1 and pattern 3 is the same, and is higher than the social welfare level in pattern 4. Pattern 3 and pattern 4's government taxation principles and private sector governance funding input rules are the same as above, that is, for each 1% increase in the level of natural degradation, the optimal tax rate or optimal funding input ratio is reduced by approximately 1%

Figure 2. Social welfare levels under different models (b = 0.5, b = 1)

3. Comparison between pattern 2 and pattern 5 shows that under the monopoly pricing mechanism, when the natural degradation level is less than 0.33, the government needs to levy taxes for resource protection, which is conducive to improving the level of social welfare. To achieve the maximum social welfare level under pattern 5, it is necessary to levy a proportional income tax on the private sector for pollution control. The optimal tax rate increases from zero to 0.33 with the level of natural degradation, and correspondingly decreases from about 33% to zero. The taxation principle is the same as above [10].

4. Conclusion
Based on the above analysis, the conclusions are as follows: (1) For the protection of tourism resources or the maximization of social welfare, investing in governance can significantly reduce pollution and increase the stock of tourism resources and the level of overall social welfare. At the same time, the demand for tourism can be controlled through a monopoly high price mechanism, which is more conducive to the protection of tourism resources, realizes the sustainable development of the tourism industry, and improves the level of social welfare. (2) When the natural degradation level of pollution is higher than a certain threshold (greater than 0.5), the optimal decision for private
or government resource protection is zero input or no taxation, relying on natural mitigation; (3) Under the monopoly pricing mechanism, when the natural degradation level is less than 0.33, in order to maximize the optimal inventory of tourism resources and social welfare, it is necessary to levy a proportional income tax on the private sector for pollution control. When the natural degradation level increases by 1%, the optimal tax rate will decrease by 1% accordingly.

According to the above conclusions, the natural degradation coefficients of different pollutants should be scientifically determined first, and then classified and treated. For pollutants with a natural degradation coefficient lower than 0.5, private or government treatment can be selected; for pollutants with a higher natural degradation coefficient (greater than 0.5), even if they are not selected for treatment; secondly, the government should give official prices to tourism products or services Guidance on optimal pricing to control tourism consumption and achieve sustainable development of the tourism industry; Finally, the independent investment of pollution by monopoly tourism enterprises for pollution control can improve the efficiency of pollution control. The government carries out policy corrections, levies taxes and subsidizes pollution control by the private sector in accordance with market measures, while achieving protection of tourism resources and increasing the level of social welfare.

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