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Can Tourism Development Help Improve Urban Liveability? An Examination of the Chinese Case

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Abstract: The emergence of "urban diseases" has aroused people's widespread concern about urban liveability. Therefore, it is worth studying whether tourism, as a "smokeless industry" can improve it. In this article, the benchmark model, the spatial Durbin model (SDM), and the panel threshold model (PTM) are constructed to test the impact of tourism development on urban liveability based on the data from 284 prefecture-level and above cities in China for the period 2004–2019. The results show that tourism development can significantly contribute to the improvement of urban liveability. Meanwhile, the positive impact of tourism development on the liveability of neighboring cities through spatial spillover effects is still valid in eastern, central, and western China, but the effect is much larger in the eastern and central cities than in the western cities. Moreover, tourism development has positive nonlinear effects on urban liveability, and the marginal effects are clearly decreasing after crossing the first and second thresholds. Finally, specific recommendations are proposed for tourism development to improve urban liveability.

Keywords: tourism development; urban liveability; spatial Durbin model; panel threshold model; China

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1. Introduction

Many countries are showing a trend of rapid urban growth. In 1950, two-thirds of the population lived in rural areas around the world. By the beginning of the 21st century, more than half of the population had become urban dwellers and the world urbanization rate is expected to reach 72% by 2050 [1]. China, as the world's largest developing country, has made remarkable achievements in urban development since "reform and opening up". The urbanization rate has increased from 17.92% in 1978 to 63.89% in 2021, and the built-up area has already exceeded 60,000 km^2 [2]. However, along with rapid urbanization, the disorderly development of cities has caused "urban diseases", such as resource shortage, traffic congestion, and ecological damage [3]. Additionally, during the ongoing spread of COVID-19, such diseases more likely to occur in clusters among urban residents due to excessive population density [4]. All of the above issues illustrate the importance of improving urban liveability. Building liveable cities is an important step to achieving sustainable development goals (SDGs) and meeting residents' aspirations for a better life [5]. Moreover, improving urban liveability not only helps to boost the happiness of residents but also contributes to attracting talent to embrace a "demographic dividend" [5,6]. In recent years, the Chinese government has paid much attention to building liveable cities. The 14th five-year plan and the long-term goal of 2035 clearly states that "transforming the way of urban development is an important goal for China at this stage. The governments need to consider the multiple demands of city dwellers for the economy, living, ecology, and security, building high-quality and sustainable urban ultimately." Thus, improving urban liveability has become an important task for local governments in the critical period of China's transformation, and how to achieve it has become an important issue to be addressed.

As one of the fastest-growing industries in the world, global tourism travellers have reached 12.310 billion and global tourism revenues have reached $5.8 trillion, equivalent to 6.7% of global GDP in 2019 [7]. At the same time, tourism is increasingly recognized as an important contributor to position creation, poverty alleviation, and environmental protection, especially concerning the sustainable development of human societies [8]. Furthermore, several international organizations such as the World Tourism Organization (UNWTO) and International Monetary Fund (IMF), have high expectations of tourism that contribute to sustainable urban development, regarding it as a key sector to promote the green transformation of traditional industries [9]. Among them, the UNWTO claims that "Tourism, as an economic powerhouse, has the potential to contribute to the SDGs" through the T4SDG platform in particular. In 2017, Tourism and the Sustainable Development Goals-Journey to 2030 also stated that tourism has played a significant role in achieving the 17 SDGs [8]. In short, tourism contributes to the improvement of urban liveability through multiple paths, such as optimizing the urban ecological environment, transforming the urban industrial structure, and improving the living conditions of urban residents. [10,11] With the increase in residents' consumptive power and willingness to travel, China's tourism has achieved rapid growth, contributing to 11.05% of GDP and 10.31% of employment in 2019 [12]. In addition, tourism has contributed significantly to the development of urban infrastructure, the urbanization rate in underdeveloped areas, and the living conditions of residents [13]. However, due to irrational tourism exploration and "overtourism", tourism development may lead to the destruction of the ecology, traffic congestion, and the increase in price levels in cities, posing a threat to urban liveability [14]. In general, there are many studies on the economic, environmental, and social effects that are caused by tourism development. However, there are relatively few academic studies on the impact of tourism development on urban livability, a complex system that combines ecological, economic, and social elements. Although some scholars have paid attention to the issue, the poor timeliness, the non-universality of the case sites, and the lack of scientific studies combining theory and empirical evidence have led to poor scientific conclusions. Moreover, as a comprehensive industry, tourism in one city may impact the urban development of many neighboring cities, especially in the context of China's "all-for-one tourism" tourism strategy. Therefore, exploring the impact of tourism development on urban livability from a spatial spillover perspective can complement the relevant theories in tourism and urban science. In addition, the destruction of urban ecology, traffic congestion, and social problems that are caused by excessive tourism needs more attention. Therefore, what exactly is the role of tourism in China's urban liveability? Does tourism development have a spatial spillover effect on the liveability of neighboring cities? Does the impact of tourism on urban liveability change as the level of tourism development increases in China? The questions that are mentioned above deserve in-depth study by scholars.

Accordingly, the possible contributions of this paper are as follows: First, it explores the mechanism of the effect of tourism on urban liveability and enriches the theoretical basis for improving urban liveability. Second, the benchmark model and the spatial Durbin model (SBM) are constructed to explore the direct and spatial spillover effects of tourism development on urban liveability. Moreover, the panel threshold model is used to test whether the effect of tourism development on urban liveability is nonlinear, making the research conclusions a more objective reality. Finally, targeted policy recommendations are given based on the findings of the study to fully exert the positive effects of tourism on the improvement of urban liveability.

The remainder of this paper is organized as follows: Section 2 is the literature review. Section 3 includes the mechanism of tourism development on urban liveability and the theoretical hypothesis. In Section 4, the variables of the article are explained and the data sources are stated. In Section 5, the empirical results are illustrated. Finally, research findings are provided and targeted recommendations are made based on the findings in Section 6.

2. Literature Review

2.1. The Relevant Research on Urban Liveability

Rapid urbanization has brought about many negative problems such as urban congestion and environmental pollution, which have stimulated mankind's desire to seek improvements in the habitat of cities. In 1898, the publication of Ebenezer Howard's book, named Garden Cities of Tomorrow (Former Name: To-morrow: A Peaceful Path to Real Reform) was a landmark event in mankind's exploration of urban liveability and a source of thought for modern urban planning [15]. Afterwards, in 1954, the Greek scholar Doxiadis founded the science of human settlement, which emphasizes that the human settlement environment is a complex system composed of nature, humans, society, and other factors [16]. In 1961, the WHO summarized the four aspects that include safety, health, convenience, and the amenities that are needed for basic human life and proposed the concept of the living environment [17]. Since then, scholars have interpreted the connotation of urban liveability from different perspectives, and the research on urban liveability has been gradually enriched. Among them, Evans [18] deemed that the evaluation of urban liveability should include both living conditions such as supporting infrastructure and appropriate income level, and ecological sustainability. Hartzkarp [19] believes that a liveable city needs to include not only a favorable ecological environment and excellent supporting infrastructures but also a deliberative democracy that is conducive to creating an open and fair social environment. In recent years, based on the connotation of urban liveability, scholars have gradually focused on the impact of external factors on urban liveability. For example, Lee [20] confirmed that the increased environmental satisfaction of residents has a positive impact on urban liveability, taking Korea as an example. Martínez-Bravo et al. [21] argue the importance of the three pillars of sustainability (economic, social, and environmental) for urban liveability, while environmental pollution has a significant negative impact on urban liveability. In addition, other scholars have discussed the impact of urban liveability from several perspectives, including green infrastructure [22], urban density [23], and resident satisfaction [24], etc. In China, the study of urban liveability started late, and the landmark event was the foundation of "the science of habitat and environment" which was founded by Liangyong Wu [25]. After that, the study of urban liveability in China mainly consisted of two aspects, one was to analyze the connotation of urban liveability based on the characteristics of Chinese cities and to measure the urban liveability index by the entropy weight method, AHP method, and Delphi method [26,27]. The second is to investigate the impact of external factors on urban liveability. For instance, Zhao et al. [6] concluded that the opening of high-speed rail has a significant positive impact on urban liveability. Liang et al. [28] explored the impact of climate extremes on urban liveability in northern and southern China, confirming that high temperatures and extreme precipitation harm urban liveability in the south and that severe cold weather harms urban liveability in the north. Although this far there is little research into the impact of multivariate factors on urban liveability, the scope of researchers has gradually expanded in recent years.

2.2. Impacts of Tourism on Urban Development

Currently, there is little research that specifically focuses on the impact of tourism on urban liveability. Among them, Liu et al. [11] investigated the interaction between tourism development and urban liveability and whether there is a threshold effect of tourism development on urban liveability. The findings show that the effect of tourism development on urban liveability is an inverted U-shaped curve, and tourism density, which serves as a threshold variable, plays a moderating role in it. In addition, Kang et al. [29] probed into the question of whether cities with high tourism development levels are also liveable, and the results confirm that there is no spatially matching relation. To date, scholars have focused more on the issues that are related to tourism in urban development. In particular, guided by sustainable development theories, the impact of tourism on urban green development has been deeply studied [12]. Moreover, the impact of tourism on urban sustainable development has been widely discussed based on the SDGs, announced by the United Nations [30]. Beyond that, scholars focus on several aspects of urban development such as ecological, economic, social, and cultural and study the impact of tourism development on such aspects. In terms of the urban ecological environment, scholars have studied the impact of tourism development on urban environmental quality, and the findings show that there is a "Kuznets Curve" between the tourism economy and the ecological environment [31,32]. On the issue of the impact of tourism development on urban economies, the mainstream view supports the existence of the tourism-led growth hypothesis (TLGH), which states that tourism development can drive the economic development of cities [33–35]. Among the studies on the impact of tourism on society and culture, some scholars argue that tourism provides richer recreational activities for urban residents [36], and others maintain that tourism improves the life qualities of urban residents [37]. However, in terms of the negative effects of tourism, some scholars believe that the development of tourism has also led to an increase in crime incidents, which is detrimental to social stability [38]. They still doubt whether tourism development can contribute to urban livability.

In summary, scholars have provided a preliminary theoretical basis and attempted to address the relationship between tourism development and urban liveability. However, most studies have only examined the impact of tourism development on some aspects of urban livability without constructing a comprehensive research framework. Although a few scholars have attempted to refine the theory, the study case sites that they used were not representative, and the data were poorly dated, which led to significant errors in the findings. Therefore, we follow the analytical logic of "theoretical construction-hypothesis formulation-empirical testing", taking China, the world's largest developing country, as an example and conducting a rigorous academic study to clarify the impact of tourism development on urban liveability and improve the theoretical framework. In addition, the existence of spatial spillover effects of tourism on urban green development has been confirmed [12], so it is worth studying whether there are spatial spillover effects of tourism development on urban liveability. Furthermore, a nonlinear relationship has been proven for tourism development on urban ecology and economic growth [31,39], so is there also a nonlinear relationship for tourism development on urban liveability? Therefore, taking 284 cities at the prefecture level and above in China as an example, this paper provides an indicator system of urban liveability, measures it using entropy-weighted TOPSIS, and then explores the direct effects, spatial spillover effects, and nonlinear characteristics of tourism development on urban liveability using the benchmark model, the spatial Durbin model (SBM) and the panel threshold model, respectively. Finally, policy suggestions that are valuable both in academic and practical fields are put forward according to the above conclusions.

3. Mechanism Analysis and Theoretical Hypothesis

The positive impact of tourism development on the ecological environment, economic development and improvement of the living environment has been verified by scholars [12,34]. Therefore, tourism development may have a direct positive impact on urban liveability, which includes multiple elements of ecology, economy and the living environment. In addition, tourism development may have an indirect impact on the liveability of neighboring cities due to the tourist flow and comprehensiveness of the tourism industry [12]. Last but not least, excessive development of tourism may have a negative impact on the ecological and living environment of the cities [11,31] and the positive marginal contribution to economic development may be reduced, so the impact of tourism development on urban liveability may have a nonlinear characteristic of diminishing marginal effects.

3.1. The Direct Impact of Tourism Development on Urban Liveability

The direct impact of tourism development on urban liveability is achieved through three main paths: ameliorating the ecological environment, spurring economic growth, and improving the living environment. From the perspective of ecology, on the one hand, when tourism development exceeds the urban environmental carrying capacity, it can damage the ecological environment [40]. However, when the scale of tourism is maintained at a reasonable level, it has a positive impact on urban ecology [9]. Specifically, tourism has a crowding out effect on highly polluting enterprises in cities [12] and the role of tourism development in increasing the awareness of eco-environmental protection among city dwellers cannot be ignored [41,42]. Moreover, ecotourism under rational planning also helps improve the ecological environment of tourism destinations and achieve sustainable urban development [43,44]. Finally, tourism revenue can provide financial support for environmental protection to realize the sustainable development of tourism [45]. In terms of the impact on economic development, the tourism-led economic growth hypothesis (TLGH) is confirmed [46,47] and is equally applicable in China [34]. Tourism promotes urban wealth accumulation by generating foreign exchange earnings [48], stimulating residential consumption [49], and increasing government tax revenues [50]. Moreover, carrying out tourism festivals, such as Oktoberfest, is also positive in driving economic growth [51]. From the perspective of the living environment, tourism provides more employment opportunities for city residents, improving their household income and living standards [52,53]. To meet the growing demand of tourists, the government accelerates the development of urban infrastructure, which provides convenience for both tourists and local residents [37]. Moreover, to improve visitor satisfaction, the community service process would be standardized and its service quality would be elevated [41]. Finally, historical and cultural heritage, as an important part of the tourism product, can be protected by local governments, which is conducive to creating a good urban cultural atmosphere [54]. In summary, tourism development can positively impact urban livability, a complex system that integrates ecological, economic, and social development.

Hypothesis 1. *Tourism development has a positive impact on urban liveability.*

3.2. Spatial Spillover Effects of Tourism Development on Urban Liveability

Tourism development positively affects the ecology, economy, and living environment through spatial spillover effects, improving the liveability of neighboring cities. First, tourism development has a positive spatial spillover effect on the ecological environment, influencing the industrial structure and types of adjacent areas. The layout of industries with low environmental pollution, such as accommodations and entertainment, in neighboring cities helps improve their ecological environment [12]. Moreover, China has adopted the development strategy of "all-for-one tourism" since 2017, which requires not only a single tourism city to have a good ecological environment but also all cities in the demonstration area to improve the quality of ecology [55,56]. Second, tourism development has a positive spatial spillover effect on economic growth, and this phenomenon in China has been confirmed by scholars [57]. Tourism activities have the attribute of mobility, driving the flow of capital, information, and talent between regions, and the economic benefits they generate may spill over to neighboring cities [11]. Moreover, tourism has a comprehensive driving effect on upstream and downstream industries that are located in neighboring cities because the materials that are needed for tourism cannot be fully supplied locally and supply by the neighborhood becomes necessary [12,58]. Furthermore, tourism development contributes to the development of infrastructure (airports, highways, etc.) which helps promote the economic growth of the neighborhood [59]. Finally, tourism can improve the living environment of neighboring cities by sharing supporting facilities and building a favorable social environment. Concretely, infrastructure such as highways and high-speed rail stations not only benefits local residents but also facilitates the lives of residents in neighboring cities [60]. In addition, with the increasing competition in tourism, cities are vigorously promoting tourism innovation to capture a small amount of the tourism market, which helps create a fine social atmosphere [61,62]. In summary, from the perspective of spatial effects, the tourism industry has positive externalities on ecological, economic, and social development, and it may positively impact the livability of the neighboring cities.

Hypothesis 2. *Tourism development positively affects the liveability of neighboring cities through spatial spillover effects.*

3.3. Nonlinear Effects of Tourism Development on Urban Liveability

While tourism development has positive significance for urban liveability, the ecological, economic, and social problems it generates may diminish its positive impact on urban liveability as the scale of tourism continues to grow. First, when the scale of tourism exceeds the tourism environment bearing capacity (TEBC), there will be ecological degradation that is caused by the overuse of resources [63], especially generating huge ecological damage to nature reserves [64]. Specifically, some aquatic recreational amenities, such as swimming and rafting, and emissions of pollutants from hotels and restaurants have a negative impact on the aquatic environment [65]. Moreover, exhaust emissions from tourist vehicles can cause damage to the atmospheric environment, leading to air pollution [66]. Worse yet, due to the excessive reception of tourists, some tourist sites with fragile ecological environments may suffer from soil erosion and land desertification [67]. Second, the contribution of tourism to economic growth is characterized by a nonlinear decreasing marginal effect as tourism grows [68], and this aspect is validated in a study using China as the case site [69]. The reason for this is that the lack of timely updating of tourism products may cause "psychological tiredness" of tourists, according to the life cycle of tourism products [70]. Moreover, the blind expansion of the tourism industry leads to reduced efficient resource allocation, and the excess of primary tourism products results in the diminishing marginal effects of tourist attractiveness [69]. Furthermore, the vulnerability of the local economy gradually became apparent due to the overdependence on tourism [71]. For example, some tourist cities are facing the grave problem of a worsening economic situation and rising unemployment due to the impact of COVID-19. Finally, as the scale of tourism gradually increases, the negative impact of tourism on the living environment is emerging. Studies have shown that the uncontrolled development of tourism can lead to a surge in crime, reducing the well-being of the local population [38]. Moreover, crowding of public facilities and noise pollution because of tourism development reduce the quality of life of local residents [72]. In addition, in Macao, for example, tourism development has led to higher land prices, resulting in a real estate bubble and a disparity between the rich and the poor [73]. In summary, the above analysis of the negative externalities on urban ecology and economic and social development that are caused by over-tourism suggests that when the scale of tourism development exceeds a threshold, its positive impact on urban livability decreases.

Hypothesis 3. *The contribution of tourism to urban liveability has a nonlinear character of diminishing the "marginal effect".*

4. Model Construction, Variables, and Data

4.1. Model Construction

4.1.1. Benchmark Model

Regression analysis is a predictive modeling technique that examines the relationship between the dependent variable (target) and the independent variable (predictor). As a fundamental model in regression analysis, the benchmark regression model has the advantages of being both scientific and convenient. Therefore, to verify that tourism development has a positive impact on urban liveability, based on Hypothesis one, the benchmark Model (1) was constructed first:

$$\begin{aligned} \ln UL_{it} = a_{it} + \beta_1 \ln TOUR_{it} + \beta_2 \ln URB + \beta_3 \ln GOV + \\ \beta_4 \ln ER + \beta_5 \ln OPEN + \beta_6 \ln HC + \beta_7 \ln TECH + \mu_i + \delta_t + \varepsilon_{it} \end{aligned} \quad (1)$$

where *UL* stands for urban liveability; *TOUR* which is represented by tourism specialization stands for tourism development; *URB* indicates the urbanization rate; *GOV* represents Government intervention; *ER* represents environmental regulation; *OPEN* represents openness; *HC* represents human capital; *TECH* represents the level of technical innovation, i and t represent city and year, respectively; β denotes the regression coefficient; μ_i and δ_t are the city and time fixed effect; and ε_{it} denotes the error term.

4.1.2. Spatial Econometric Model

Based on Hypothesis two, to examine the spatial spillover effect of tourism development on urban liveability, a spatial econometric model was selected for empirical analysis. However, before constructing the spatial econometric model, Moran's I and *Getis-Ord Gi** indices were used to explore the spatial characteristics of urban liveability through global and local spatial autocorrelation, respectively [35]. The expressions are (2) and (3), respectively:

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(Y_i - \overline{Y})(Y_j - \overline{Y})}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} (i \neq j) \quad (2)$$

where i, j denotes different cities, $S^2 = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \overline{Y})^2$, $\overline{Y} = \frac{1}{n}\sum_{n=1}^{n} Y_i$, Y_i, Y_j represent the observations on the spatial cell, w_{ij} is the spatial weight matrix, and I takes values between -1 and 1. The spatial correlation is negative when the value of I is less than -1, spatially uncorrelated when it is equal to 0, and spatially positive when it is greater than 0. The larger the absolute value of I is, the stronger the spatial correlation.

$$G_i^*(d) = \sum_{j=1}^{n} w_{ij}(d)P_j \Big/ \sum_{j=1}^{n} P_j \quad (3)$$

where n denotes the number of cities, P_j represents the observed values of urban liveability on spatial units, w_{ij} is the spatial weight matrix, and *Gi** is close to 0, which means that the observed values are randomly distributed in the region, and the larger the absolute value of *Gi** is, the more likely it is to form a hot-spot area or a cold-spot area.

The theory of spatial econometrics suggests that a certain economic geographic phenomenon in one spatial unit is correlated with the same phenomenon in neighboring spatial units and ignoring the spatial correlation of study units may lead to biased regression results, so spatial econometric models need to be used to study economic geographic phenomena. Based on the measurement of the spatial agglomeration index of urban liveability, spatial econometric models were subsequently constructed. The spatial econometric models mainly include the spatial lag model (SRM), spatial error model (SEM), and the spatial Durbin model (SDM). The spatial Durbin model, as a comprehensive form of the spatial error model and spatial lag model and without endogeneity problem [57], fits well with the study of the spatial spillover effect of tourism development on urban liveability, and the model expression is (4):

$$\begin{aligned} \ln UL_{it} &= \rho W \ln UL_{it} + \beta_1 \ln TOUR + \beta_2 X_{it} + \\ &\theta_1 W \ln TOUR_{it} + \theta_2 W X_{it} + \mu_i + \delta_t + \varepsilon_{it} \end{aligned} \quad (4)$$

where W is the spatial weight matrix, and the geographical weight matrix and the economic and geographical nested matrix are selected in this paper. Among them, the geographical distance between cities is calculated based on the geographical coordinates between cities, and the economic data are selected as the difference between the average value of GDP per capita of each city from 2004 to 2019. ρ is the spatial regression coefficient of the explanatory variable, and β_1 and β_2 are the spatial regression estimation coefficients of the explanatory variable and the control variables, respectively. θ_1 and θ_2 are the spatial regression estimated coefficients of the explanatory and control variables, respectively. μ_i

and δ_t are the city and time fixed effect, ε_{it} is the random error term, and X denotes the control variable.

4.1.3. Threshold Model

To test Hypothesis three, that is, whether tourism development has a nonlinear effect on urban liveability, this paper explores the threshold effect of tourism development on the urban livability. The threshold effect refers to the phenomenon that when one economic parameter reaches a specific value, another related economic parameter suddenly turns to other development forms. In the early empirical research, grouping tests or adding interaction terms to the model were used to study the "threshold effect" of variables. However, the results of such tests are random and cannot be tested for significance. Hansen's threshold effect model can not only estimate the threshold value but also perform a significance test on the rationality of the existence of the threshold value. Therefore, the panel threshold model that was proposed by Hansen [74] was used to examine whether the correlation between the explanatory variables and the explained variables changed when the threshold was crossed. This paper chose tourism specialization (TS) and tourist as population proportion (TP), which characterize tourism development, as the threshold variables, and the Equations are (5) and (6), respectively:

$$UL = a_0 + a_1 TS_{it} * I(TS_{it} \leq \gamma_1) + a_2 TS_{it} * I(\gamma_1 < TS_{it} < \gamma_2) + a_3 TS_{it} * I(TS_{it} \geq \gamma_2) + \lambda Z_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (5)$$

$$UL = a_0 + a_1 TP_{it} * I(TP_{it} \leq \gamma_1) + a_2 TP_{it} * I(\gamma_1 < TP_{it} < \gamma_2) + a_3 TP_{it} * I(TP_{it} \geq \gamma_2) + \lambda Z_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (6)$$

where UL denotes the explanatory variable, TS and TP denote tourism specialization and tourist as population proportion, respectively, which are both threshold variables and core explanatory variables. i represents the region, t represents the year, and γ represents the threshold. $I(\cdot)$ represents an indicator function taking the value 1 or 0 with the numerical value set as 1 if the condition in parentheses is met; otherwise, it is 0. Z_{it} denotes the exogenous control variable, μ_i and δ_t are the city and time fixed effect, and ε_{it} denotes the random perturbation term.

4.2. Variables

4.2.1. Explained Variable

Urban liveability (UL) is a composite system that includes the urban ecological environment, economic development, and living environment, and it is an orderly state in which elements coexist harmoniously [6,75]. The EIU (economist intelligence unit) has measured the urban livability indices of 172 major cities worldwide, and some scholars have measured the urban livability indices based on surveys or statistical data. The urban livability evaluation system that we constructed is mainly based on the SENCE (social-economic-natural complex ecosystem) theory [76], which comprehensively evaluates the level of urban development from three aspects: social, economic, and ecological environment. In addition, we also refer to the urban livability index system that was constructed by Shi et al. [75] and other related research results [77]. The urban livability index system both optimizes the EIU's urban livability evaluation system and incorporates China's urban development status, which is scientific. Specifically, the urban ecological environment, economic development, and living environment are the three major categories (Table 1). Among them, the ecological environment has a great impact on the quality of life of city dwellers, affecting the health of residents and the level of sustainable urban development. The urban ecological environment was represented by three subcategories, including pollution control capacity, waste discharge, and environmental quality and eight indicators, such as the urban sewage treatment rate. Second, strong economic strength is the basis of the proper functioning of the cities, and it is expressed by three subcategories which include productive capacity, employment and income, and commodity provision, and eight indicators such as GDP per capita were selected to characterize it. Finally, a good living environment is the underlying purpose of improving urban liveability. The three subcategories, including infrastructure, education, and medical care were chosen to represent the living environment. Among them, infrastructure is the foundation to ensure the convenience of daily life, meanwhile, education and medical care are closely related to the basic survival needs of residents. Moreover, nine indicators such as the number of college students per 10,000 people, were chosen for characterization.

Table 1. Evaluation index system of urban liveability.

Category	Sub-Category	No.	Indicator	Attribute	Weights
Ecological Environment	Pollution Control	1	Treatment rate of domestic sewage (%)	+	0.0050
		2	Harmless treatment rate of domestic waste (%)	+	0.0109
		3	Comprehensive utilization rate of industrial solid waste (%)	+	0.0083
	Waste Discharge	4	Industrial wastewater discharge per 10,000 population (unit)	−	0.0633
		5	Industrial sulfur dioxide emission per 10,000 population (unit)	−	0.0178
		6	Industrial smoke emission per 10,000 population (unit)	−	0.0178
	Environmental Quality	7	Greening coverage rate of built-up area (%)	+	0.0081
		8	Annual average concentration of inhalable particles (mcg/m^3)	−	0.0369
Economic Development	Industrial Development	9	Proportion of output value of secondary industry in GDP (%)	+	0.0734
		10	Proportion of output value of tertiary industry in GDP (%)	+	0.0290
		11	Per capita GDP (yuan)	+	0.0565
	Employment and income	12	Number of employees at the end of the year (10,000 people)	+	0.0989
		13	Average wage of employees (yuan)	+	0.0739
		14	Registered unemployment rate (%)	−	0.0819
	Commodity Provision	15	Per capita retail sales of consumer goods (yuan)	+	0.0653
		16	Total sales of goods in wholesale and retail trade (10,000 yuan)	+	0.0678
Living Environment	Infrastructure	17	Number of theatres and theaters per 10,000 population (unit)	+	0.0275
		18	Number of public libraries per 10,000 population (unit)	+	0.0625
		19	Number of gymnasiums per 10,000 population (unit)	+	0.0709
		20	Investment in public infrastructure (10,000 yuan)	+	0.0477
	Education	21	Number of college students per 10,000 population (unit)	+	0.0242
		22	Number of colleges and universities (unit)	+	0.0201
		23	Educational fund (10,000 yuan)	+	0.0109
	Medical Treatment	24	Number of doctors (licensed doctor and licensed assistant doctor) (unit)	+	0.0112
		25	Number of beds in medical institutions per 10,000 population (unit)	+	0.0101

After constructing the index system of urban livability, this paper adopts the entropy-weighted TOPSIS method, which is widely used in the evaluation of development levels, to calculate the urban livability index. The entropy-weighted TOPSIS method is composed of two parts: the entropy method can effectively solve the interference of subjective weighting on the objectivity of the evaluation results, and the TOPSIS method can rank cities by comparing their urban livability levels with the closeness of the optimal solution. The calculation steps are as follows:

The first step is to normalize the data. In order to eliminate the influence of different dimensions of each indicator on the evaluation results, we use the range method to standardize the original data. Among them, Formulas (7) and (8) correspond to the calculation process of the positive and negative indices, respectively.

$$X_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}} \tag{7}$$

$$X_{ij} = \frac{\max x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}} \tag{8}$$

where X_{ij} denotes the normalized value of indicator j of city i and x_{ij} denotes the original value of indicator j of city i.

The second step is to normalize the data.

$$P_{ij} = Y_{ij} / \sum_{i=1}^{m} Y_{ij} \tag{9}$$

The third step is to calculate the information entropy E_j of the indicator j in year t.

$$E_j = -\frac{1}{\ln m} * \sum_{t=1}^{m} P_{tj} * \ln P_{tj} \tag{10}$$

The fourth step is to calculate the weight W_j of each indicator.

$$W_j = \frac{1 - E_j}{\sum\limits_{j=1}^{n} (1 - E_j)} \tag{11}$$

Finally, we can get the urban livability index Z_i of each city.

$$Z_i = \sum_{j=1}^{n} W_j * P_{ij} \tag{12}$$

4.2.2. Core Explanatory Variable

Tourism development (*TOUR*). At present, scholars mainly use two types of indicators to measure tourism development: tourism specialization (*TS*) and tourist population proportion (*TP*). The connotation of the former is the ratio of total tourism revenue (the sum of the domestic and inbound tourism revenue) to regional GDP [34,68], and the connotation of the latter is the ratio of tourism trips (the sum of domestic and inbound tourism trips) to the regional population [33]. This paper used tourism specialization (*TS*) as the core explanatory variable and the tourist population proportion (*TP*) considered as the replacement variable for the explanatory variable in the ADF test.

4.2.3. Threshold Variable

Tourism specialization (*TS*) and Tourist population proportion (*TP*). To test whether there is a nonlinear effect of tourism development on urban liveability, *TS* and *TP*, which characterize tourism development, were selected as threshold variables for the threshold test, respectively. Tourism specialization was expressed as the ratio of total tourism revenue to local GDP and tourist as population proportion was represented as the ratio of tourism trips to the total urban population.

4.2.4. Control Variables

To make the findings more accurate, six control variables were selected after referring to the relevant literature [6], including urbanization (*URB*), government intervention (*GOV*), environmental regulation (*ER*), openness (*OPEN*), human capital (*HC*), and technical innovation (*TECH*). Specifically, urbanization was expressed as the ratio of the urban resident population to the total population. Government intervention was expressed by the ratio of local fiscal expenditure to GDP. Environmental regulation was characterized by the amount of industrial sulfur dioxide removal. Openness was characterized by the share of foreign direct investment in GDP. Human capital was characterized by the number of students that were enrolled in general higher education institutions as a share of the total population. Finally, technical innovation was characterized by R&D expenditure. Table 2 shows all of the variables.

Table 2. Variable selection and connotation.

Variable	Variable Name	Connotation	Symbol
Dependent variable	Urban liveability	UL calculated by entropy weight TOPSIS method	*lnUL*
Independent variable	Tourism development	Proportion of tourism revenue in GDP	*lnTOUR*
Threshold variable	Tourism specialization	Proportion of tourism revenue in GDP	*TS*
	Tourist as population proportion	Proportion of total tourist arrivals in the total population	*TP*
Control variable	Urbanization	Proportion of urban population in total population	*lnURB*
	Government intervention	Proportion of local fiscal expenditure in GDP	*lnGOV*
	Environmental regulation	Industrial sulfur dioxide removal	*lnER*
	Openness	Proportion of foreign direct investment in GDP	*lnOPEN*
	Human capital	Proportion of students in colleges and universities in the total population	*lnHC*
	Technical innovation	R&D expenditure	*lnTECH*

4.3. Data

In this paper, we studied 284 cities at the prefecture level and above in China, including a total of 4 municipalities directly under the Central Government (Beijing, Shanghai, Chongqing, and Tianjin) and 280 prefecture-level cities, which are classified according to the Report on Adjusting the Criteria for Establishing Municipalities that was issued by the Chinese State Council. In addition, in the heterogeneity analysis, we divided China's cities into eastern, central, and western cities, of which there are 100 cities in the east, 100 cities in the center, and 84 cities in the west (Figure 1). The criteria for defining cities in eastern, central, and western China are based on the Method of Dividing East, West, Central, and Northeast China that was issued by the State Council of China. Moreover, due to the lack of data before 2011 and some data not being updated after 2020, we collected statistics from 2011 to 2019. The data that were used in this paper were obtained from the China Statistical Yearbook (2005–2020), China Urban Statistical Yearbook (2005–2020), China Environmental Statistical Yearbook (2005–2020), China Tourism Statistical Yearbook (2005–2020), and the statistical bulletin of each city from 2004 to 2019. However, the data on the annual average concentration of respirable particulate matter cannot be obtained from the above sources; hence, it was selected from the China Environmental Energy Economy Database (Website: https://www.epsnet.com.cn/index.html#/) (accessed on 31 May 2022). The missing data were filled in by linear interpolation.

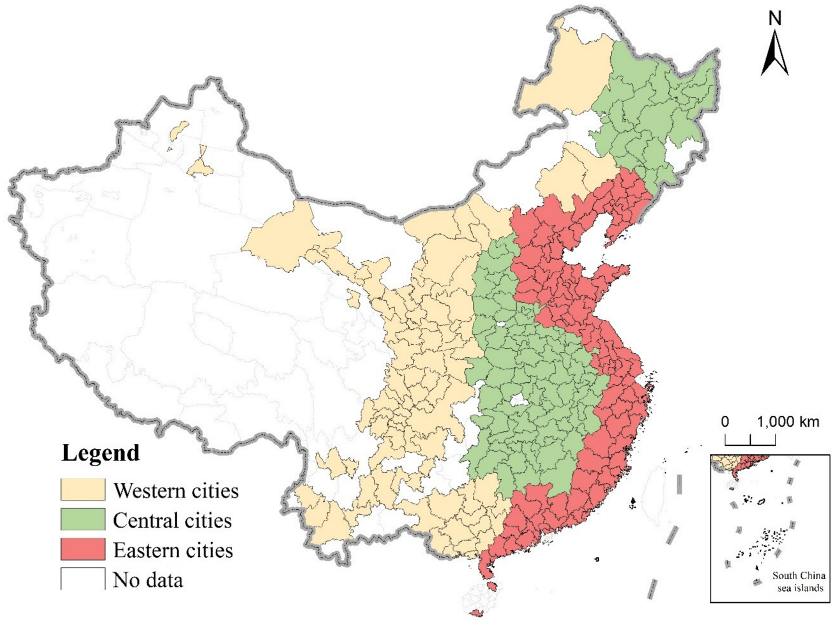

Figure 1. Distribution of Study cities and their location.

5. Empirical Results and Analysis

5.1. Spatial-Temporal Analysis

5.1.1. Temporal Evolution of Urban Liveability

The results in the boxplot (Figure 2) show that the average value of liveability of Chinese cities has a steady upwards trend, from 0.229 in 2004 to 0.286 in 2019, but the height of the "boxes" has increased continuously, indicating that the differences in the urban liveability index have gradually widened. Moreover, the scatterplots in the diagram show that the levels of urban liveability are always in a "pyramid" structure, indicating that the number of low-level cities is always the largest, while the number of high-level cities is always small. According to the estimation of the kernel density of the urban liveability index (Figure 3), it can be seen that the center of the kernel density curve has moved to the right, the slope of the curve has gradually flattened out, the width of the "peak body" has gradually widened, and the height of the peak has decreased significantly, indicating the "club convergence" characteristic of urban liveability, which means that the liveable and non-liveable cities are clustered in space has emerged. In addition, the curve has a long tail that gradually elongates over time to the right, indicating that the gap between extremely liveable cities and unliveable cities gradually widens. This phenomenon may be due to the fact that China's urban development follows the "core-edge" theory that was proposed by Friedman, which has led to a continuous shift of development factors to the eastern regions of China. The gap between the infrastructure construction, medical and educational standards, and economic development of the eastern cities and the central and western cities is gradually widening.

5.1.2. Spatial Characteristics and Evolution Trend of Urban Liveability

According to Figure 4, in general, the spatial characteristics of urban liveability in China are distributed in a "core-periphery" structure which shows that cities with high liveability are located in the core area, while low liveable cities are located in the peripheral area. The "core area" is mainly located in the central and eastern regions of China, including the North Plain, the Middle-Lower Yangtze Plain, and the eastern coastal region. The "peripheral area" that is characterized by poor climatic conditions, sparse population, inconvenient transportation, and poor economic development is located in the northeastern and western China. Specifically, the cities with extremely high liveability are mainly municipalities directly under the central government and provincial capitals in China, including Beijing, Shanghai, Guangzhou, and Wuhan, while the cities with poor liveability are distributed contiguously in China's inland and frontier provinces, such as Guangxi, Yunnan, Guizhou, and Heilongjiang. In terms of evolutionary trends, the spatial distribution pattern of urban liveability remains unchanged. Concretely, the low and extremely low liveable cities occupy the overwhelming majority during the whole period, even showing a trend of continuous expansion in space, especially the cities that are located in the Loess Plateau. In contrast, the number of highly liveable cities and extremely highly liveable cities is small, decreasing from 32 to 25 from 2004 to 2019.

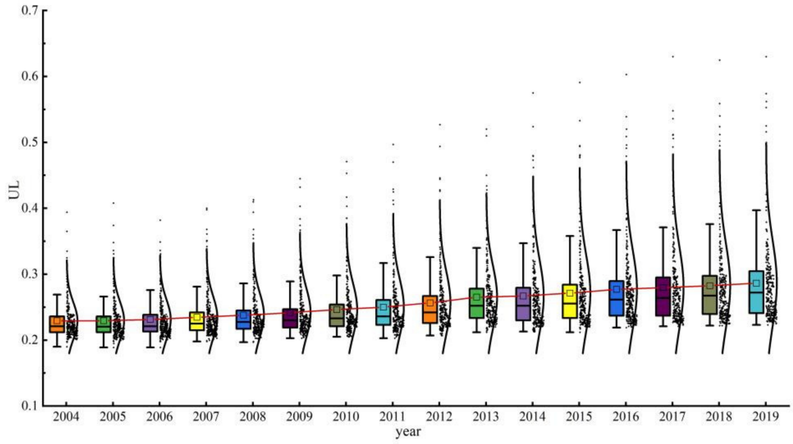

Figure 2. Boxplot of urban liveability index evolution.

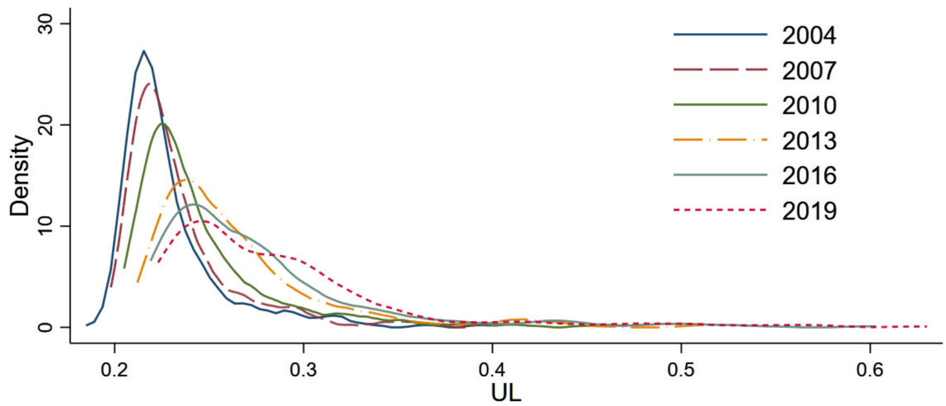

Figure 3. Kernel density curve of urban liveability index evolution.

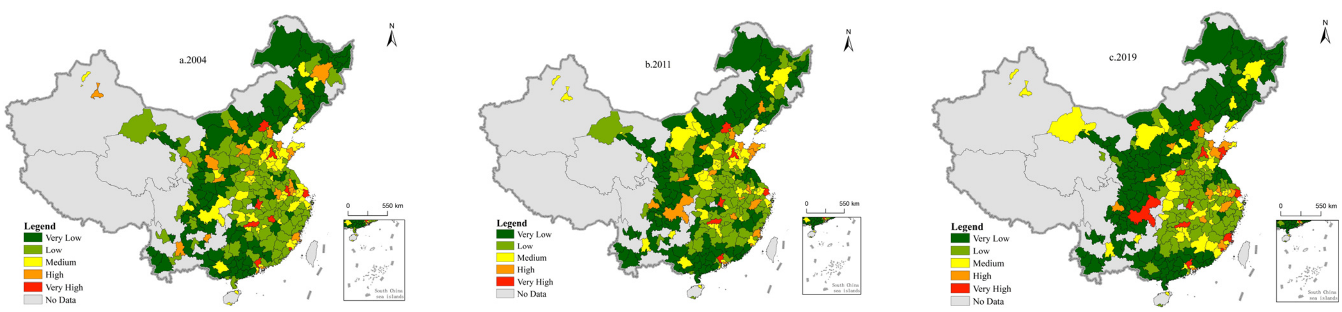

Figure 4. Spatial distribution of urban liveability in year (**a**) 2004, (**b**) 2011, and (**c**) 2019.

5.1.3. Spatial Clustering Characteristics of Urban Liveability

Moran's *I* is used to detect the global spatial auto-correlation of urban liveability in China from 2004 to 2019. The results in Table 3 show that Moran's *I* of urban liveability was positive during 2004–2019 and passed the significance test under the 1% significance level, indicating that urban liveability has a significant positive spatial agglomeration. Moreover, the value has increased gradually, indicating that the spatial agglomeration is gradually increasing.

Table 3. Moran' s I of urban liveability.

Years	Geographic Distance Weight Matrix	Economic-Geographical Distance Nested Matrix	Years	Geographic Distance Weight Matrix	Economic-Geographical Distance Nested Matrix
2004	0.035 ***	0.324 ***	2012	0.041 ***	0.346 ***
2005	0.032 ***	0.315 ***	2013	0.061 ***	0.367 ***
2006	0.024 ***	0.318 ***	2014	0.053 ***	0.362 ***
2007	0.030 ***	0.316 ***	2015	0.054 ***	0.352 ***
2008	0.035 ***	0.301 ***	2016	0.061 ***	0.349 ***
2009	0.037 ***	0.303 ***	2017	0.062 ***	0.349 ***
2010	0.041 ***	0.332 ***	2018	0.062 ***	0.372 ***
2011	0.037 ***	0.340 ***	2019	0.070 ***	0.356 ***

Note: *** represent significance at the 1% significance levels.

To test the specific spatial agglomeration feature, *Getis-Ord Gi** is used to examine the characteristics of the local spatial auto-correlation of urban liveability. As shown in Figure 5, there are two major "hot-spot" agglomerations in which the northern "hot-pot" agglomeration is located on the northern edge of the North China Plain and Shandong Peninsula, and the southern "hot-pot" agglomeration is located in the Middle-Lower Yangtze Plain. This phenomenon is because the two regions, located in the middle and lower reaches of the Yellow River and Yangtze River basins, are the "pioneers" of urban construction in China. They also have good natural conditions and a good foundation for socio-economic development. Specifically, the area of the northern "hot-pot" agglomeration changed from small to large in 2004–2011 and decreased from 2011 to 2019. Moreover, there are three "cold spot" agglomerations, which are located in Guangxi Province, Sichuan, and Gansu Province, as well as the Liaohe Plain and Songnen Plain in northeast China. These cities are mainly located in the northeastern and western regions of China, which are the "marginal areas" of China's urban construction, and the urban livability is poor. The area of the above three agglomerations has a trend of continuous increase, and the phenomenon of "low-level balance" of urban liveability is apparent.

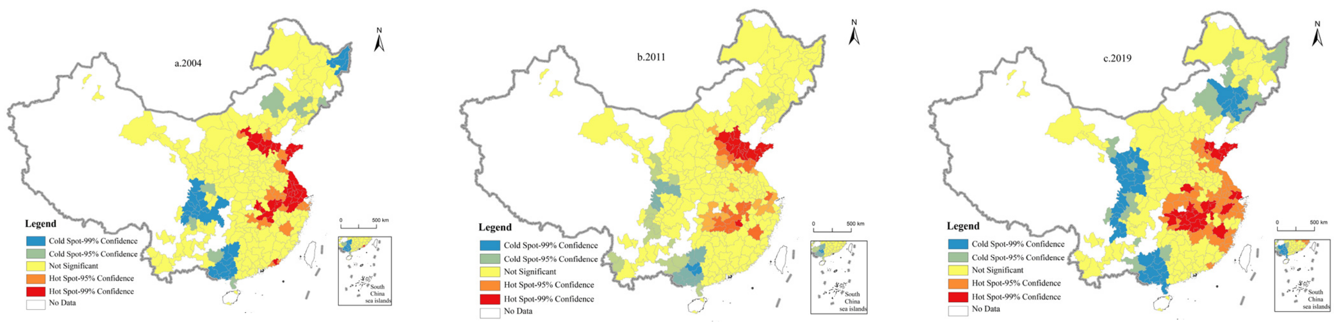

Figure 5. *Getis-Ord Gi** of urban liveability in year (**a**) 2004, (**b**) 2011, and (**c**) 2019.

5.2. Analysis of Benchmark Regression Results

First, without considering the control variables, the ordinary least squares model (OLS), fixed-effects model (FE), and random-effects model (RE) are constructed to perform preliminary tests (Table 4). The results of Models (1)–(3) show that tourism development has a positive impact on urban liveability at the 1% significance level. Subsequently, to obtain more robust results, the results are re-estimated after adding control variables. From the results of Models (4)–(6), it can be seen that tourism development still has a positive impact on urban liveability at the 1% significance level, with an increase of 0.0533-0.0728 in the urban liveability index for every 1 unit increase in the level of tourism development, so Hypothesis one is confirmed.

Table 4. Benchmark regression results.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	**FE**	**RE**	**OLS**	**FE**	**RE**
lnTOUR	0.0477 *** (17.14)	0.0835 *** (45.13)	0.0823 *** (44.77)	0.0533 *** (13.45)	0.0696 *** (18.28)	0.0728 *** (19.59)
lnURB				0.0103 *** (4.76)	0.0018 (0.79)	0.0032 (1.49)
lnGOV				0.0554 *** (12.41)	0.0202 *** (3.66)	0.0055 (1.10)
lnER				0.0053 *** (5.53)	0.0009 (0.82)	0.0027 ** (2.59)
lnOPEN				−0.0086 *** (−6.97)	−0.0098 *** (−6.34)	−0.0064 *** (−4.39)
lnHC				0.0529 *** (29.07)	0.0246 *** (14.33)	0.0292 *** (17.37)
lnTECH				0.0537 *** (46.61)	0.0369 *** (37.17)	0.0400 *** (41.46)
Constant				1.8418 *** (123.61)	1.4891 *** (79.91)	1.5634 *** (85.4)
N	4544	4544	4544	4544	4544	4544
R^2	0.0607	0.3235	0.3235	0.6206	0.4703	0.5511

Note: The clustered standard error values are in parentheses. **, and ***, respectively, represent significance at the 5% and 1% significance levels.

Among the control variables, urbanization had a positive impact on urban liveability despite its correlation coefficient not being significant under the FE model and RE model, which is perhaps because the massive inflow of population provided sufficient labor for urban economic growth and forced the upgrading of urban infrastructure support. Government intervention was found to be positively related to urban liveability despite the insignificant correlation coefficient under the RE model, validating the findings of related scholars [12]. Environmental regulations had a positive effect on the improvement of urban liveability at the 5% significance level under the OLS and RE models, indicating that the adoption of strict environmental regulations led to an increase in the "compliance costs" of highly polluting enterprises and forced them to move out of the cities, contributing to the improvement of the urban ecological environment. Openness was negatively related to urban liveability, suggesting that FDI was not conducive to the improvement of urban liveability in China. The hypothesis of a "pollution haven" was verified, and this conclusion is consistent with Liu et al.'s findings [13]. Human capital and technology innovation were all positively associated with urban liveability, indicating that human capital and technology innovation significantly enhanced urban liveability. This is because human capital is the source of urban innovation, and technological innovation can promote the upgrading of the industrial structure [78].

5.3. Spatial Panel Model Regression Analysis

5.3.1. Statistical Testing of Model Selection

Spatial econometric models of tourism development on urban liveability are constructed based on the geographic distance spatial weight matrix and the economic and geographic distance nesting matrix. The LM test, LR test, Wald test, and Hausman test are performed to discern which type of spatial econometric model is best to choose (Table 5). First, based on the results of the LM test, both the SEM and the SAR models are suitable are suitable for selection, so the spatial Durbin model (SBM) combining the SEM and SAR model is chosen as the optimal solution. Then, the LR test and Wald test are performed to determine whether the SDM model should be downgraded to the SEM or SAR model, indicating that the SDM model is optimal compared with the SEM and SAR models, so the SDM model should not be changed. Finally, the results of the Hausman test show that the fixed-effects model is the optimal choice. In conclusion, an SDM with fixed effects is the best solution to analyze the spatial spillover effects of tourism development on urban liveability.

Table 5. Statistical testing of model selection.

Inspection Method	Geographic Distance Weight Matrix		Economic-Geographical Distance Nested Matrix	
	Characteristic Value	*p*-Value	Characteristic Value	*p*-Value
LM-Lag test	320.00	0.000	319.607	0.000
Robust LM-Lag test	130.461	0.000	130.461	0.000
LM-Error test	212.00	0.000	212.262	0.000
Robust LM-Error test	23.10	0.000	23.116	0.000
LR-Lag test	105.15	0.000	157.81	0.000
LR-Error test	132.23	0.000	214.55	0.000
Wald-Lag test	105.00	0.000	158.73	0.000
Wald-Error test	135.53	0.000	214.52	0.000
Hausman test	816.91	0.000	1330.21	0.000

5.3.2. Spatial Spillover Effects

Table 6 shows that every 1% increase in tourism development could result in a corresponding increase of 0.4041% compared to adjacent cities, passing the test at the 1% significance level under the geographic weight matrix. Similarly, under the economic and geographical nested matrix, every 1% increase in tourism development could result in a corresponding increase of 0.0272% compared to adjacent cities, passing the test at the 1% significance level. The above results provide preliminary evidence that tourism development can positively affect the liveability of neighboring cities through spatial spillover effects. However, LeSage and Pace [79] argue that testing the spatial spillover effect using the point estimation method results in large errors, so we further analyze it according to the results of the partial differential estimation.

Table 6. Spatial regression results.

Variable	Geographic Distance Weight Matrix	Economic-Geographical Distance Nested Matrix
lnTOUR	0.0734 *** (3.61)	0.0337 *** (7.43)
lnURB	0.1015 *** (3.38)	0.0512 *** (6.44)
lnGOV	0.1926 *** (4.98)	0.0372 *** (3.50)
lnER	0.0838 *** (4.49)	−0.0048 (1.64)
lnOPEN	−0.0158 (−1.18)	−0.0006 (−0.23)
lnHC	0.0073 (0.30)	−0.0124 *** (−3.64)
lnTECH	0.0380 *** (3.84)	0.0077 ** (2.41)
W × *lnTOUR*	0.0289 *** (14.42)	0.0272 *** (13.94)
W × *URB*	0.0058 (1.47)	−0.0108 *** (−2.89)
W × *lnGOV*	−0.0039 *** (−7.53)	0.0091 * (1.84)
W × *lnENVI*	−0.0007 (−0.58)	0.0013 (1.02)
W × *lnOPEN*	−0.0012 (−1.33)	−0.011 (−1.27)
W × *lnHR*	0.0178 ***(12.16)	0.0190 *** (13.00)
W × *lnTECH*	0.0072 ***(4.39)	0.0125 ***(8.82)
Spatial effect	YES	YES
Time effect	YES	YES
R^2	0.152	0.1789
Log-likelihood	7761.1085	7793.3056

Note: The clustered standard error values are in parentheses. *, **, and ***, respectively, represent significance at the 10%, 5%, and 1% significance levels.

The partial differential estimation allows the spillover effects of tourism development on urban liveability to be further decomposed into direct, indirect, and total effects. Among them, the direct effect reflects the direct impact of tourism development on the liveability of the cities, the indirect effect reflects the impact of tourism development on the liveability of neighboring cities, and the total effect refers to the sum of the direct and indirect effects. The results of effect decomposition are shown in Table 7. First, from the perspective of the direct effect, the estimated coefficients of the impact of tourism development on urban liveability are significantly positive at the 1% significance level, indicating that tourism development still has a positive effect on urban liveability after considering spatial factors, further verifying Hypothesis one. Then, from the perspective of the spatial spillover effect, under the geographic distance weighting matrix, every 1% increase in tourism development could result in a corresponding increase of 0.0311% compared to its adjacent cities, passing the test at the 1% significance level. Moreover, it can be seen that every 1% increase in tourism development could result in a corresponding increase of 0.0293% compared to its adjacent cities, passing the test at the 1% significance level under the economic and geographical nested matrix. In summary, tourism development can significantly promote the level of liveability of neighboring cities, so Hypothesis two is valid. Furthermore, comparing the estimated coefficients of indirect effects under two different spatial weight matrices, the spatial spillover effect of tourism development on the liveability of neighboring cities is more significant under the geographic weight matrix, which indicates that the spatial spillover effect of tourism development depends more on the spatial correlation of geographic distances between cities. This is because economic development is only one aspect that affects urban liveability, which does not play a decisive role, so building liveable cities should not ignore other factors such as ecological and living environment [75]. Moreover, the tourist flows between cities can be blocked by the overlong geographical distance. Although the levels of economic development between cities are similar, the neighboring cities still cannot receive the positive spatial spillover effects of tourism development through the tourist flows if the geographical distance is too long.

Table 7. Decomposition results of spatial effects.

Variable	Geographic Distance Weight Matrix			Economic-Geographical Distance Nested Matrix		
	Direct Effect	**Indirect Effect**	**Total Effect**	**Direct Effect**	**Indirect Effect**	**Total Effect**
lnTOUR	0.6021 *** (3.05)	0.0311 *** (14.76)	0.6332 ** (3.20)	0.0585 *** (9.96)	0.0293 *** (14.59)	0.0878 *** (13.98)
lnURB	0.6603 *** (2.90)	0.0079 ** (2.17)	0.6683 *** (2.94)	0.0676 *** (6.54)	−0.0085 ** (−2.41)	0.0590 *** (5.52)
lnGOV	0.9757 *** (2.88)	−0.0358 *** (−7.21)	0.9399 ** (2.78)	0.0550 *** (3.87)	0.0106 ** (2.25)	0.0656 *** (4.50)
lnER	0.5137 *** (2.88)	0.0011 (0.84)	0.5148 *** (2.88)	−0.0058 (−1.38)	0.0011 (0.87)	−0.0048 (−1.04)
lnOPEN	−0.1071 (−1.24)	−0.0016 * (−1.73)	−0.1087 (−1.25)	−0.0014 (−0.42)	−0.012 (−1.33)	−0.0025 (−0.71)
lnHC	0.1286 (0.80)	0.0184 *** (11.73)	0.1469 (0.91)	0.0187 ** (12.75)	−0.0094 ** (−2.05)	0.0930 * (1.80)
lnTECH	0.2706 *** (3.22)	0.0082 *** (4.12)	0.2788 *** (3.31)	0.0161 *** (3.77)	0.0131 *** (8.76)	0.0292*** (1.34)

Note: The clustered standard error values are in parentheses. *, **, and ***, respectively, represent significance at the 10%, 5%, and 1% significance levels.

5.3.3. Heterogeneity Analysis

Since there are differences in tourism development and urban liveability among the cities of different regions in China, we further test the heterogeneity of cities that are divided into eastern, central, and western cities to determine if there was any difference in the effect of tourism development on urban liveability. Table 8 shows that the regression results are basically consistent between the geographic weight matrix and the economic and geographic nested matrix. First, from the perspective of the direct effect, the estimated coefficients of the impact of tourism development on urban liveability are positive in all regions, among which the regression results of eastern cities are valid at the 1% significance level, the regression results of central cities are valid at the 5% significance level, while the regression results of western cities are insignificant. Moreover, from the perspective of the spatial spillover effect, it can be seen that the estimated coefficients of the impact of tourism development on the liveability of neighboring cities are positive in the eastern, central and western regions at the 1% significance level, indicating the tentative positive spatial spillover effects of tourism development on the liveability of neighboring cities in each region tentatively.

Table 8. Spatial regression results of regional heterogeneity.

Variable	Eastern Region		Central Region		Western Region	
	Geographic Distance Weight Matrix	**Economic-Geographical Distance Nested Matrix**	**Geographic Distance Weight Matrix**	**Economic-Geographical Distance Nested Matrix**	**Geographic Distance Weight Matrix**	**Economic-Geographical Distance Nested Matrix**
lnTOUR	0.1334 *** (5.36)	0.0258 *** (3.49)	0.0432 ** (2.08)	0.0236 ** (2.59)	0.0439 (1.44)	0.0005 (0.06)
$W \times lnTOUR$	0.0442 *** (11.46)	0.0202 *** (5.49)	0.0287 *** (8.62)	0.0293 *** (8.90)	0.0158 *** (4.83)	0.0147 *** (4.53)
Control variable	YES	YES	YES	YES	YES	YES
Direct effect	0.4409 *** (3.20)	0.0511 *** (4.92)	0.0552 ** (2.25)	0.0362 *** (3.39)	0.0361 (1.63)	0.0018 (0.23)
Indirect effect	0.0391 *** (9.89)	0.0229 *** (6.05)	0.0287 *** (8.42)	0.0301 *** (8.88)	0.0159 *** (4.74)	0.0059 * (1.37)
Total effect	0.4801 *** (2.90)	0.0740 *** (6.53)	0.0839 *** (3.46)	0.0663 *** (5.89)	0.0520 ** (1.92)	0.0077 * (1.83)
Spatial effect	YES	YES	YES	YES	YES	YES
Time effect	YES	YES	YES	YES	YES	YES
R^2	0.1996	0.1800	0.1239	0.1009	0.0001	0.1750
Log-likelihood	2777.7625	2839.6568	2863.1929	2858.2544	2328.6842	2349.8636

Note: The clustered standard error values are in parentheses. *, **, and ***, respectively, represent significance at the 10%, 5%, and 1% significance levels.

To overcome errors in the point estimation results, the partial differential method is used to test the influence of tourism development on urban liveability in all regions. First, the estimated coefficients of the direct effects of each region are significantly positive under the two different weight matrices, indicating the spatial heterogeneity of East > Central > West, which is consistent with the findings under point estimation. Moreover, from the perspective of the spatial spillover effect, the estimated coefficients of eastern, central, and western cities are 0.0391, 0.0287, and 0.0159, respectively, and all of them pass the test at the 1% significance level under the geographic weight matrix. In addition, under the economic and geographical nested matrices, the estimated coefficients of eastern, central, and western cities are 0.0229, 0.0301, and 0.0059, respectively, and all of them pass the test at the 10% significance level. Overall, tourism development in all regions can enhance the liveability of neighboring cities through spatial spillover effects, with the positive spatial spillover effects in the eastern and central regions being much larger than those in the western region.

The reasons for the spatial heterogeneity of the positive spatial spillover effect of tourism development on urban liveability are as follows: first, from the perspective of the impact on the ecological environment of neighboring cities, the modernization of the tourism industry in the central and eastern regions, especially in the eastern region is higher, so local tourism enterprises invest in technology research and development to pursue higher production efficiency, sharing innovative achievements to compensate for the negative impact that is caused by the relocation of highly polluting enterprises on the ecology of neighboring cities. In addition, the complete tourism cooperation mechanism makes it easier for the companies upstream and downstream of the industry chain that are located in neighboring cities to share low-carbon environmental technologies in the central and eastern cities. In contrast, on the one hand, tourism is currently in the early stages of development, and the competitive consciousness among cities is greater than cooperative awareness, resulting in difficulties in sharing experience in sustainable tourism development in western cities. On the other hand, the green development concept of tourism mostly comes from eastern cities, and the spillover effect of the scientific tourism development concept from western cities on the ecological improvement of neighboring cities is weak. Second, from the perspective of the impact on the economic development of neighboring cities, the central and eastern regions have large-scale sources of tourists with high consumption levels and complete tourism transportation, which helps to form a "big market" of tourism and facilitates the redistribution of wealth among the cities. By comparison, in the western region, the scale of tourism is limited in each city, and effective tourism links and cooperation are rare because of the long geographical distance between cities, so the economic income that is generated by tourism cannot flow freely between different cities. Finally, in terms of the spatial spillover effect on the living environment, cities in the central and eastern regions are mostly connected together in the form of megalopolises. Moreover, the highways, high-speed railway stations, airports, and other supporting facilities that are built for tourism development can cover multiple cities and improve the convenience of life of residents within the entire urban agglomeration. However, the pattern of the spatial distribution of cities in the west is mainly dotted, which makes it impossible to share the support facilities that are established for tourism development, so tourism has little effect on improving the living environment of residents of neighboring cities. In summary, the regression results show that the positive spatial spillover effect of tourism development on urban liveability is significantly lower in the western region than in the central and eastern regions are reasonably explained.

5.3.4. Robustness Check

Referring to related studies [57], this paper conducts robustness tests on the regression results by changing spatial econometric models and adjusting explanatory variables to make the conclusions more convincing. First, the spatial lag model (SRM) and the spatial error model (SEM) are used to test the effect of tourism development on urban liveability. As shown in Table 9, the result is that tourism development has a positive effect on urban liveability, which can prove the robustness of the research findings. In addition, tourism specialization (TS), the proxy variable that characterizes tourism development is replaced by tourist population proportion (TP) to verify whether tourism development still has a positive spatial spillover effect on urban liveability. Table 9 shows that the coefficient of the spatial lag term ($W \times lntour$) is positive under all the weight matrices at the 1% significance level. Then, the impact of tourism development on urban liveability is analyzed using three dimensions: direct effect, indirect effect, and total effect. Their estimated coefficients are significantly positive under different weight matrices, which indicates that tourism development still plays a significant positive role in promoting the liveability of local and neighboring cities when tourist as population proportion is taken as a proxy variable. Therefore, based on the above results, it can be stated that the study findings are robust.

5.4. The Threshold Effect of Tourism Development on Urban Liveability

5.4.1. Threshold Test

In this paper, the panel threshold regression model that was proposed by Hansen [74] is used to analyze the nonlinear relationship of tourism development on urban liveability with tourism specialization (TS) and tourist as population proportion (TP) as threshold variables to characterize tourism development. The samples are repeatedly drawn 1000 times by the bootstrap method to test whether there is a threshold effect on tourism development, and the figures that show the estimated values of the two threshold variables are separately made by Stata16.

Table 9. The results of the robustness check.

Variable	SEM		SAR		Replace Explanatory Variable	
	Geographic Distance Weight Matrix	Economic-Geographical Distance Nested Matrix	Geographic Distance Weight Matrix	Economic-Geographical Distance Nested Matrix	Geographic Distance Weight Matrix	Economic-Geographical Distance Nested Matrix
lnTOUR	0.0320 *** (16.59)	0.0279 *** (13.81)	0.0323 *** (16.67)	0.0302 *** (15.53)	0.0261 *** (9.89)	0.0339 *** (5.83)
$W \times lnTOUR$					0.0133 (0.58)	0.0147 *** (5.88)
Control variable	YES	YES	YES	YES	YES	YES
Direct effect			0.03316 *** (16.13)	0.0309 *** (15.16)	0.0718 (0.46)	0.0573 *** (7.33)
Indirect effect			0.2591 *** (3.38)	0.0178 *** (9.76)	0.0262 *** (10.05)	0.0169 *** (6.55)
Total effect			0.2922 *** (3.78)	0.0487 *** (14.22)	0.098 (0.63)	0.0742 *** (8.89)
Spatial effect	YES	YES	YES	YES	YES	YES
Time effect	YES	YES	YES	YES	YES	YES
R^2	0.2513	0.3323	0.009	0.3308	0.1595	0.0234
Log-likelihood	7694.9949	7686.0323	7708.5358	7714.3982	7681.6285	7692.5931

Note: The clustered standard error values are in parentheses. *** represents significance at the 1% significance levels.

In Figure 6, the point position corresponding to the value of the likelihood function at the lowest point represents the threshold value. Specifically, both the single and double thresholds of tourism specialization (TS) and tourist as population proportion (TP) pass the test at the 1% significance level, and none of the triple threshold effects are significant, so the double threshold model is constructed for analysis. In Table 10, the two threshold points are 0.2887 and 0.5575 when tourism specialization (TS) is the threshold variable separately, and the threshold points are 9.4596 and 15.5771 when the tourist as population proportion (TP) is the threshold variable.

5.4.2. Threshold Effect

First, the regression results are tested with tourism specialization (TS) as the threshold variable. As shown in Table 11, when $TS \leq 0.2887$, every 1% increase in tourism development can result in a corresponding increase of 0.1410% in urban liveability, passing the test at the 1% significance level, and the marginal effect of the positive impact of tourism development on urban liveability is greatest at this stage. When $0.2887 < TS < 0.5575$, the estimated coefficient of the impact of tourism development on urban liveability is 0.0666, which passes the test at the 1% significance level, indicating a diminishing marginal effect of the positive impact of tourism development on urban liveability after crossing the first threshold. When $TS \geq 0.5575$, every 1% increase in tourism development can merely result in a corresponding increase of 0.1410% in urban liveability, passing the test at the 1% significance level, indicating that the marginal effect of the positive impact of tourism development on urban liveability is minimized when the share of tourism revenue exceeds 55.75% of the local GDP. In addition, a comparative study is conducted using tourist as population proportion (TP) as the threshold variable. The marginal effect of the positive impact of tourism development on urban liveability is maximum when $TP \leq 9.4596$, with every 1% increase in tourism development enhancing the level of urban liveability by 0.0050% at the 1% significance level. When $9.4596 < TP < 15.5771$, the positive impact on urban liveability decreases to 0.0039% for every 1% increase in tourism development, with a diminishing marginal effect. When the second threshold is crossed, TP ≥ 15.5771, every 1% increase in tourism development merely results in a corresponding increase of 0.0024% in urban liveability at the 1% significance level.

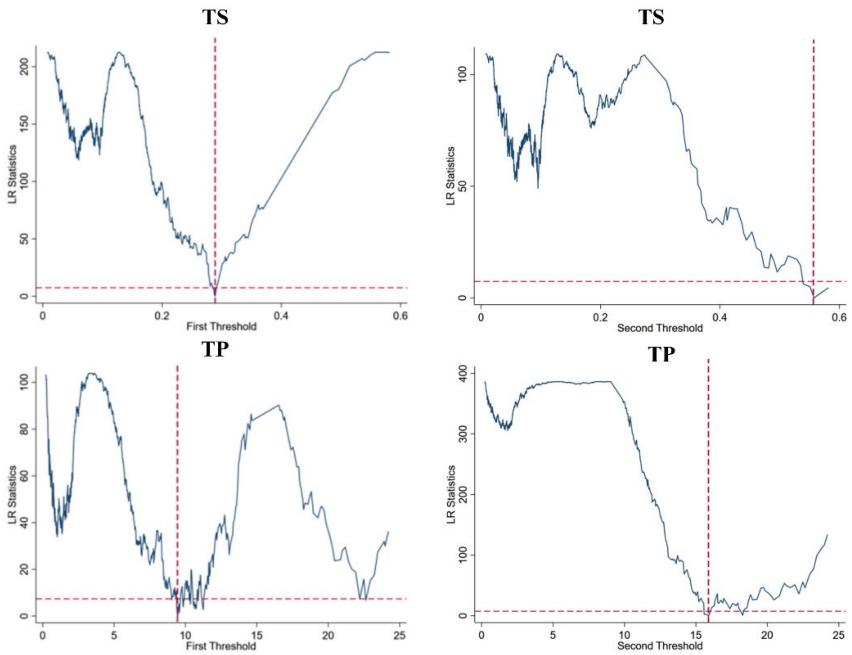

Figure 6. The test and confidence intervals for the thresholds in urban liveability.

Table 10. Threshold effect test.

Explained Variable	Threshold Variable	Threshold Number	F-Statistics	Critical Value			Threshold Estimated Value	Lower	Upper
				10%	5%	1%			
UL	TS	Single	249.38 ***	98.9403	107.786	118.7325	0.2887	0.2873	0.2899
	TS	Double	109.44 ***	64.4554	71.7345	86.7925	0.5575	0.5430	0.5817
	TP	Single	501.11 ***	85.0144	99.0850	138.0330	9.4596	9.4014	9.4897
	TP	Double	106.78 ***	41.3252	44.6013	54.4891	15.5771	15.5461	15.6678

Note: *** represents significance at the 1% significance levels.

Table 11. Threshold regression results.

Variable	TS		TP	
	Regression Coefficient	*T*-Value	Regression Coefficient	*T*-Value
TS ≤ 0.2887	0.1410 ***	20.74		
0.2887 < TS < 0.5575	0.0666 ***	15.04		
TS ≥ 0.5575	0.0240 ***	8.01		
TP ≤ 9.4596			0.0050 ***	34.68
9.4596 < TP < 15.5771			0.0039 ***	41.44
TP ≥ 15.5771			0.0024 ***	37.14
URB	0.0088 ***	7.55	0.0018 *	1.73
GOV	0.0674 ***	11.30	0.0232 ***	4.49
ENVI	-3.19×10^{-10}	−0.59	-2.34×10^{-10}	−0.50
OPEN	−0.0341	−6.42	−0.0321	−6.99
HR	6.69×10^{-5} ***	21.59	0.0001 ***	20.70
TECH	0.0006 ***	33.06	0.0005 ***	34.20
Constant	0.2080 ***	141.18	0.2170 ***	169.96
R-squared	0.5190		0.5520	

Note: * and ***, respectively, represent significance at the 10% and 1% significance levels.

In summary, whether tourism specialization (TS) or tourist as population proportion (TP) is used as the threshold variable, the marginal effect of the positive impact of tourism on urban liveability decreases step by step when the first and second threshold values are crossed, respectively. The above findings can verify Hypothesis three, echoing the conclusions of Liu et al.'s study [77] and indicating that the positive impact of tourism development on urban liveability is not a monotonically increasing relationship but rather that the positive impact on urban liveability diminishes with the development of tourism and may even become negative in the future.

6. Conclusions, Policy Implications, and Discussion

6.1. Conclusions

The rapid development of cities has brought about a series of problems such as traffic congestion and environmental pollution, which affect the improvement of urban liveability. At the same time, tourism has been verified to have a positive impact on the ecological improvement and urban economic development and so on, so the development of tourism may also have an important value to improve urban liveability. In view of this, based on the data from 284 prefecture-level and above cities in China from 2004 to 2019, entropy-weighted TOPSIS is used to measure urban liveability, and then a benchmark model, the spatial Durbin model (SDM) and a threshold model are constructed to test the effect of tourism development on urban liveability. The findings show the following:

(1) The average value of the urban liveability index in China has gradually increased, while the gap in liveability has gradually widened among cities. The spatial distribution of urban liveability shows a "center-periphery" structure with high liveability in the central and eastern cities and low liveability in the western and northeastern cities. In terms of spatial agglomeration characteristics, there is global spatial autocorrelation in urban liveability from 2004 to 2019 and the spatial agglomeration is gradually increasing, while the "hot-spots" are in the densely populated central and eastern regions and the "cold-spots" are in the western and northeastern peripheral regions.

(2) Tourism development has a significant positive effect on urban liveability. Every 1% increase in tourism development could result in a corresponding increase in urban liveability of 0.0533%, 0.0696%, and 0.0728% under the ordinary least squares model (OLS), fixed-effects model (FE), and random-effects model (RE), respectively. From the perspective of the spatial spillover effect, tourism development can positively affect the liveability of neighboring cities, and the finding still holds in the eastern, central, and western regions. However, the spatial spillover effect of tourism development on urban liveability has significant regional heterogeneity, with the positive spatial spillover effect much greater in the eastern and central regions than in the western region.

(3) The positive effect of tourism development on urban liveability is characterized by a "nonlinear" decreasing marginal effect. The threshold variables, tourism specialization (TS) and tourist as population proportion (TP), which are representative of tourism development have a double threshold effect on urban liveability, and the degree of positive impact on urban liveability decreases twice after crossing the first and second thresholds, respectively.

6.2. Policy Implications

(1) In view of the positive effect of tourism development on urban liveability, local governments should vigorously develop tourism to take advantage of its role in promoting industrial structure upgrading and economic growth transformation. At the same time, the principle of "ecological priority" in tourism development needs to be followed, keeping in mind the scientific assertion that "Clear waters and green mountains are as good as mountains of gold and silver" as President Xi said and correctly handling the relationship between tourism development and ecological environmental protection in order to achieve sustainable development of tourism.

(2) In view of the positive spatial spillover effect of tourism development on the liveability, the fragmented tourism pattern needs to be broken and tourism growth poles should be established to promote the gradual development of tourism in neighboring cities, so that each city can enjoy the positive spatial spillover of the ecological environment, economic development and living environment brought by tourism development. At the same time to avoid the waste of resources and market chaos that is brought about by disorderly competition, local governments should correctly recognize the industrial strength and tourism resources to implement the strategy of differentiated development.

(3) In response to the spatial heterogeneity of the positive spatial spillover effect of tourism development on urban liveability, the central and eastern cities should adhere to the sustainable development of tourism, taking market demand as the guide and vigorously developing new tourism modes such as sports tourism and industrial tourism. Meanwhile, governments should rely on local technological advantages to promote the construction of intelligent tourism and the digital transformation of tourism. In contrast, the governments of western cities need to vigorously promote tourism development, abandoning the vice of "mass-demolishing and mass-construction" of tourism development and developing low-carbon tourism scenic spots and supporting facilities. Moreover, trying to improve the current situation backwards tourism transportation and implementing the strategy of regional tourism integration contributes to the healthy development of tourism.

(4) In response to the diminishing marginal effect of the positive impact of tourism development on urban liveability, local governments should establish a comprehensive monitoring system of tourism carrying capacity to prevent ecological disasters and traffic congestion that is caused by the over-reception of tourists. At the same time, the relationship between tourist attractions and community residents should be properly handled, and the benefit linkage mechanism should be improved to achieve sustainable development of tourism. Finally, governments should strengthen the market supervision of tourism places to prevent the emergence of disorderly competition and other vicious behaviors that damage the image of tourism places.

6.3. Discussion

With the rapid urbanization around the world, a series of "urban diseases" have appeared, so the topic of urban livability has attracted the attention of many scholars. They have explored the impact on urban livability from a variety of perspectives, including the construction of high-speed railroads and climate change [6,28]. As a green industry, tourism is a vital force in achieving the United Nations 2030 SDGs. It may also play a massive role in improving urban livability. Therefore, it is a valuable academic question to explore the impact of tourism on urban livability.

This paper constructs a theoretical framework of the impact of tourism development on urban livability. It also proves that tourism development positively affects urban livability, which corroborates the study of Liu et al. [11]. They concluded that tourism could drive urban livability in the early stages of the Tourism Area Life Cycle (TALC). However, they also believed that as the scale of tourism expands, its impact on urban livability would change from positive to negative, which is inconsistent with our findings. We only find that when the size of tourism crosses a specific threshold, its positive impact on urban livability diminishes. It may be because the research data they used is just the panel data of 35 large and medium-sized cities in China before 2012, with small sample size and poor data timelines. Since 2017, the Chinese government has proposed to promote the upgrading of the tourism industry, which has shifted from high growth to high-quality development. The problems of the inflation of prices, urban traffic congestion, and reduced social security that are caused by tourism have been appropriately resolved. Therefore, as the tourism development level increases, tourism's positive effect on urban livability in China will be much more significant than its harmful effect. However, the positive effect shows a diminishing marginal effect, indicating that urban tourism development should be maintained appropriately. All in all, more robust conclusions can be drawn when we use the recent data and a larger sample size for the study. In addition, this paper also investigates the spatial spillover effects of the impact of tourism development on urban livability, filling the gaps of previous studies.

The theoretical contributions are as follows: First, we construct a research framework on the impact of tourism development on urban livability and demonstrate that tourism development can promote the improvement of urban livability in China. Second, this paper further investigates the spatial spillover effects of tourism development on urban livability, complementing existing research. We also explore the urban heterogeneity of spatial spillover effects and provide policy recommendations. Finally, we provide a theoretical and empirical research paradigm that can be extended to the research of the impact of tourism development on urban livability in other countries.

However, the study has the following limitations: First, the construction of urban liveability indicators is mostly based on statistical data, so there is a lack of data that were obtained from field research and questionnaire surveys. Second, the empirical tests of the impact of tourism development on urban liveability lack the inclusion of intervening and exogenous variables, resulting in a lack of clear information on the transmission paths that are involved. In the future, models such as mediating effects can be constructed to deeply analyze the various transmission paths of tourism on urban liveability. Finally, we only selected 284 cities at the prefecture level and above in China as the study subjects, which lacks relevant research on cities at smaller scales. Therefore, in the future, county-level cities in China can be taken as the study subjects to explore whether the findings of the study still hold true at different scales.

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