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Research on Innovative Models for Modern Tourism Economic Growth in the Context of Digital Transformation

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Abstract To address the issues in the current tourism economic model, this paper proposes an innovative model for tourism economic growth. To validate the guiding role of this model in tourism economic growth, an empirical research plan for the innovative model of tourism economic growth is designed. Based on the “Porter Diamond Model” of modern tourism economics, 10 influencing factors for this model are selected, along with corresponding data sources. Data analysis methods such as correlation analysis and regression analysis are employed to explore the guiding role of the innovative model for modern tourism economic growth in promoting tourism economics. When tourism resources increase by 1 unit, tourism economic growth increases by 0.0571 units. Additionally, through spatial weight matrices, Moran's I index, stationarity tests, and unit root tests, it was found that this model exhibits spatial effects. Therefore, a spatial econometric model was employed to explore the spatial effects of this model. When tourism resources in adjacent regions increase by one unit, tourism economic growth in this region increases by 0.0802 units. This effectively interprets the spatial effects of the innovative model for modern tourism economic growth in the digital context, providing reference and guidance for enhancing the development of the tourism industry economy.

Index Terms Porter's Diamond Model, regression analysis, correlation analysis, spatial effects, tourism economy

I. Introduction

As an important component of the national economy, the tourism industry has made an indelible contribution to promoting economic growth. The development of the tourism industry has driven the growth and integration of related industries, created employment opportunities, increased corporate revenue, and stimulated consumption and investment across various sectors [1], [2]. Against the backdrop of the integration of culture and tourism, the tourism industry has also served as an ambassador for cultural exchange and dissemination, fostering mutual understanding and friendship between different nations [3], [4]. However, after being hit by the “COVID-19 pandemic” black swan event, China's tourism industry has seen sluggish economic growth [5]. The new tourism models emerging from the integration of the digital economy and tourism have disrupted traditional tourism activity production, transaction, and information exchange methods, driving the iterative upgrading of traditional tourism and providing new momentum for the recovery and development of the tourism economy [6]-[8].

Digital technology is empowering tourism economic growth, specifically through the use of VR, blockchain, big data, and other digital technologies to enhance tourism marketing, tourism infrastructure, and tourism governance capabilities, providing strong momentum for tourism economic growth [9], [10]. From the early days of computer reservations and online distribution systems to the application of new-generation information technologies, the tourism industry has accelerated innovation in business models, management models, and service models [11]. It has also expanded the boundaries of tourism products, services, experiences, and consumption, promoting the transformation of development patterns, structural adjustments, and enhanced growth momentum in the tourism industry [12], [13]. Additionally, the digital economy has effectively expanded the scale of the tourism market, improved the efficiency of tourism resource allocation, reduced pollutant emissions, and cultivated growth points for green and low-carbon development in the tourism industry, bringing about scale effects, technological effects, and structural effects in the tourism industry [14]-[17]. Therefore, conducting a detailed analysis of the issues related to economic growth during the digital transformation of the tourism industry is a hot topic for enriching and expanding the application of the digital economy and promoting high-quality development of the tourism industry.

The tourism economy is an inevitable product of human societal development and an important component of the national economy. Li, K. X., et al. conducted an analysis of the reasons behind the tourism industry's impact on regional economic growth, pointing out that by regulating government revenue channels and external economic factors, tourism efficiency and productivity can be effectively stimulated, thereby strengthening the economic growth

effects of the tourism industry [18]. Wang, J., et al. assessed the role of dynamic tourism carrying capacity in tourism economic growth, emphasizing the need to focus on improving the external environment of tourism destinations while strengthening visitor management strategies to effectively increase the total volume of the tourism economy [19]. Sokhanvar, A. et al. studied emerging market economies to explore the causal relationship between tourism industry development and domestic economic construction, finding a certain correlation between international tourism revenue and economic growth, providing insights for the formulation of industrial development policies [20]. Danish and Wang, Z. investigated the dynamic interrelationship between economic growth, tourism, and environmental quality. The results indicated that while the tourism industry promotes economic development, it also causes environmental degradation. Therefore, formulating environmentally adaptive tourism economic growth guidance policies is of significant importance [21]. Rodríguez, C. et al. examined the application effects of the circular economy model in tourism industry development, indicating that the tourism industry results in high energy consumption and environmental pollution. The integration of the circular economy will promote economic growth while also making the tourism industry more sustainable [22]. Brida, J. G. et al. constructed a tourism economic growth detection model based on minimum spanning trees and hierarchical trees, using GDP increments and inbound tourist growth rates as indicators, and introduced dynamic path distances between countries to detail the impact of the tourism industry on national economic growth [23]. Liu, A., and Wu, D. C. discussed the spillover effects of tourism productivity, represented by external economic factors, on the tourism industry. When overall economic productivity improves, inbound tourism demand expands rapidly, while when tourism sector economic productivity improves, domestic tourism consumption grows more rapidly [24]. It can be seen that the growth model of the tourism economy is relatively single-dimensional, focusing on increasing production efficiency, improving the environment, and enhancing management. Although this growth model is unavoidable in the early stages of tourism development, it becomes increasingly problematic as the industry matures, particularly in terms of the vulnerability of the sector due to over-reliance on tourists.

The digital economy plays a significant role in promoting the real economy and has demonstrated disruptive impacts in the tourism economy sector. Yu, M., et al. analyzed the theoretical implications of the digital economy in enabling high-quality tourism development, examining aspects such as supply-demand matching, industrial upgrading, and macroeconomic regulation. Based on this analysis, they proposed effective pathways for advancing the digitalization of the tourism industry to accelerate tourism digital transformation [25]. Almeida-Santana, A., et al. indicate that internet platforms have transformed the operational models of tourism institutions. Developing tourism marketing strategies based on destination information from sharing economy platforms represents an innovative model for promoting tourism economic growth [26]. Kurniati, P. S., and Suryanto, S. emphasize that government policies are crucial for developing the digital tourism economy. Scientific policies facilitate the marketing of tourism community products and play a significant role in regional economic growth [27]. Moreno-Izquierdo, L., et al. argue that the contradiction between the tourism sector's reliance on demand innovation and its lack of innovative capacity is a sufficient condition for the development of tourism digital transformation, and they elaborate on the advantages of digital innovation for tourism development from multiple perspectives [28]. Wu, H. pointed out that conducting tourism activities using technologies such as the internet significantly enhances the consumption level of tourism services. Additionally, developing big data-driven tourism marketing management and improving consumer experiences through precise marketing are of great significance for promoting the growth of tourism and related service consumption [29]. Dredge, D. and Gyimóthy, S. studied the relationship between the digital collaborative economy and tourism development. Compared to economic development models that only achieve monetary transactions through digital media, the collaborative economy can influence both individual and collective levels in society, thereby promoting tourism economic development [30]. Tang, R. used the spatial Durbin model to explore the impact of the digital economy on the economic benefits of the tourism industry. The digital economy significantly improved the total factor productivity of tourism enterprises, and the resulting spatial diffusion effects contributed to the rapid development of the tourism industry [31]. The above studies indicate that different forms of digital economy innovation models have a significant impact on the economic resilience of the tourism industry. Therefore, it is important to study digital tourism economic development models that are adapted to the current era.

This paper first examines the issues facing modern tourism economic models in the digital age from four distinct perspectives. In response to these challenges, it proposes an innovative growth model for modern tourism economics. To validate the model’s guidance for tourism economic growth, an empirical research framework is established. Drawing on the “Porter Diamond Model” of modern tourism economics, the paper identifies 10 key influencing factors for the proposed model and specifies corresponding data sources. Using Pearson's correlation coefficient and multiple linear regression models, empirical research is conducted on the innovative model for modern tourism economic growth in the digital age. To ensure the rigor of the research, spatial weight matrices, Moran's index, stationarity tests, and unit root tests are employed to validate the spatial effects of the model. It is

found that the model exhibits significant positive and negative spatial effects. To further explore these spatial effects, the spatial panel autoregressive model from spatial econometric models is adopted for in-depth analysis.

II. Research on Innovative Models for Modern Tourism Economy in the Context of Digitalization

II. A. Problems with the modern tourism economic model

II. A. 1) Lack of personalized products

First, there is an insufficient understanding of tourist needs. In the context of the digital economy, tourists have increasingly diverse and personalized demands for tourism products and services. However, some modern tourism operators lack a deep understanding of tourist needs, unable to provide more precise tourism services—including attractions, service quality, and transportation—and thus fail to gain tourists' favor, thereby impacting tourist satisfaction and loyalty. Second, there is a lack of distinctive tourism products. Some modern tourism operators offer highly homogeneous products and services, primarily focusing on rural inns and picking gardens, lacking innovation and uniqueness. Tourists struggle to experience distinctive and personalized services when selecting tourism products and services. Finally, service levels are relatively low. Compared to the well-developed tourism service systems in urban areas, some modern tourism operators fall short in terms of service thoroughness and attention to detail.

II. A. 2) Inability to establish a shared mechanism between the government, enterprises, and farmers

Currently, another major challenge facing the development of modern tourism is the lack of a collaborative and shared mechanism within the tourism industry. This is primarily manifested in the following ways: first, the integration of modern tourism resources is insufficient, resulting in the failure to establish an open, orderly, and shared industrial partnership network. This prevents the full realization of the tourism industry's integration capabilities and hinders the rational allocation of the six key elements of tourism—accommodation, transportation, sightseeing, shopping, and entertainment—leading to an incomplete tourism industry chain. Second, the failure to establish a reasonable interest-sharing mechanism involving “government + enterprises + farmers” has prevented modern tourism development from truly benefiting users. Therefore, in the development of modern tourism, it is essential to establish a sharing mechanism involving multiple stakeholders and to promote innovation in business operating models.

II. A. 3) Inadequate management model

In the context of digital transformation, modern tourism economic growth models and marketing models also face some challenges. First, management models are inadequate. Some modern tourism operators lack scientific and reasonable management models, with management methods and tools being relatively simple and rudimentary, and lacking standardized management systems and operational mechanisms. This often leads to issues such as unstable tourism prices, inconsistent service quality, and poor visitor experiences. Second, outdated marketing models are also one of the main factors hindering the development of tourism economic growth models. Some operators lack internet-era marketing strategies and tools, making it difficult to build brand awareness. They often resort to traditional promotional methods, such as distributing flyers and posting posters, failing to adopt digital marketing concepts. This results in poor promotional effectiveness, limited channels for attracting visitors, and an inability to accurately target specific visitor groups, all of which impact the sustainable development of the modern tourism industry.

II. A. 4) Lack of professional talent

Currently, the modern tourism economy growth model lacks professional talent, which impacts the industry's sustainable development. This is primarily manifested in the following aspects: First, there is a shortage of professional management talent. Particularly in areas such as project planning, operational management, and marketing, there are shortcomings that hinder efficient operations and management. Second, there is a shortage of professional technical talent. For example, talent in areas such as data analysis, internet technology, and marketing cannot effectively leverage the advantages of the digital economy to drive the digital transformation and development of rural tourism. Third, there is a shortage of professional service personnel. For example, there is a lack of talent in areas such as tour guides, tourism consultants, and catering services, which prevents the provision of high-quality services and experiences, thereby affecting visitor satisfaction.

II. B. Innovative Models for Modern Tourism Economic Growth

II. B. 1) Building a modern tourism brand

Currently, traditional culture has received significant attention from the state, and various efforts to excavate and organize traditional cultural resources are being carried out in an orderly manner. The excavation and organization

of modern tourism resources should fully leverage the roles of professional teams and academic teams to advance research on the theory of the ancient postal road and its academic application. Collaborate with local universities, sports departments, tourism departments, and research institutions to deeply explore modern tourism resources, strengthen the tracing of modern tourism resources, collaborate with professional photography teams to track and film, using the footage as promotional material for modern tourism, and based on the collected data, develop scripts for filming, creating audio-visual materials, and organizing them into promotional advertisements. Collaborate with institutions of all levels to cultivate inheritors and promote national spirit, creating modern tourism brands that meet user needs, thereby driving the growth of the modern tourism economy.

II. B. 2) Cultivating Professional Talent

In the digital economy era, cultivating tourism talent with digital capabilities is crucial for the sustainable development of modern tourism. Efforts should be made to accelerate the pace of digital talent cultivation, break through the geographical limitations of traditional teaching, and establish an integrated digital talent cultivation model that spans disciplines, fields, and institutions. Strengthen collaboration with universities to address the digital development needs of the tourism industry. Optimize the curriculum of relevant programs, increase the teaching content of digital technologies and tourism management knowledge, and introduce teaching methods such as case studies, practical projects, and simulated training to enhance students' practical skills and problem-solving abilities. Establish a joint training mechanism for digital talent development. Share educational resources and launch interdisciplinary digital talent cultivation projects. For example, collaborate with the School of Computer Science to establish a Digital Tourism Technology program, cultivating talent with expertise in digital technology and tourism management. Collaborate with the School of Cultural Heritage to establish a Digital Cultural Heritage Protection and Preservation program, cultivating talent with capabilities in digital cultural heritage protection and preservation, and promoting the healthy and sustainable development of the modern tourism economy.

II. B. 3) Building modern tourism infrastructure

"If you want to get rich, you must first build roads", roads are the fundamental guarantee for the development of the economy and tourism industry. To improve the road facilities for modern tourism, it is necessary to ensure that tourists can "enter". It is also necessary to ensure that local modern tourism products "go out". The establishment of a digital road indication system can make it more convenient for tourists to be familiar with tourist routes, scenic spots, etc., and build a "tourism service consulting service center" to solve the needs of tourists. Improve supporting facilities for transportation services, build gas stations, parking lots, car maintenance and other services, and speed up the construction of water, electricity, public toilets and other infrastructure. Relying on ethnic minority autonomous counties and autonomous villages, we will establish traditional tourist towns with ethnic characteristics, combine local ethnic characteristics, create special diets and special accommodation environments, and allow tourists to integrate into tourism with ethnic characteristics. In terms of the construction of catering and accommodation facilities, it is necessary to fully consider the comfortable experience of tourists, and the location of accommodations and entertainment should be as close as possible to reduce the situation of tourists running around. Improve the tourism environment, increase the supervision of the ecological environment and accommodation environment in the tourist area and along the route, and ensure the cleanliness, hygiene, comfort and civilization of the tourist destination. In the construction of infrastructure, we should pay attention to the protection of the original ecological national traditional environment, do a good job in planning and design, protect the traditional national human resources, ensure the creation of sports tourism in the original color of the ancient post road, promote the development of local tourism and cultural industries, and then drive the transformation of the local economy, so that the results of cultural heritage protection can benefit the local people more.

III. Empirical Research Plan for Innovative Models in Tourism Economics

III. A. Influencing factors

III. A. 1) The Porter Diamond Model of the Modern Tourism Economy

The Porter Diamond Model, as shown in Figure 1, illustrates that the selection of modern tourism economic development models is the result of objectively analyzing their competitive advantages and then strengthening and leveraging them. Porter argues that four factors determine the competitiveness of an industry in a country or region: production factors, demand conditions, performance of related industries, development strategies, and competitors. This paper identifies these factors by analyzing the conditions for tourism economic development at the county level.

(1) Tourism development factors: including tourism resources, county-level economic foundation, geographical location, and infrastructure.

(2) Tourism market demand: including the structure, size, and quality of the tourism market.

(3) Relationship with surrounding tourism resources: manifested as complementary and substitute relationships.

(4) Tourism development strategy and competitors: the positioning of the modern tourism industry and the development status of homogeneous tourist attractions.

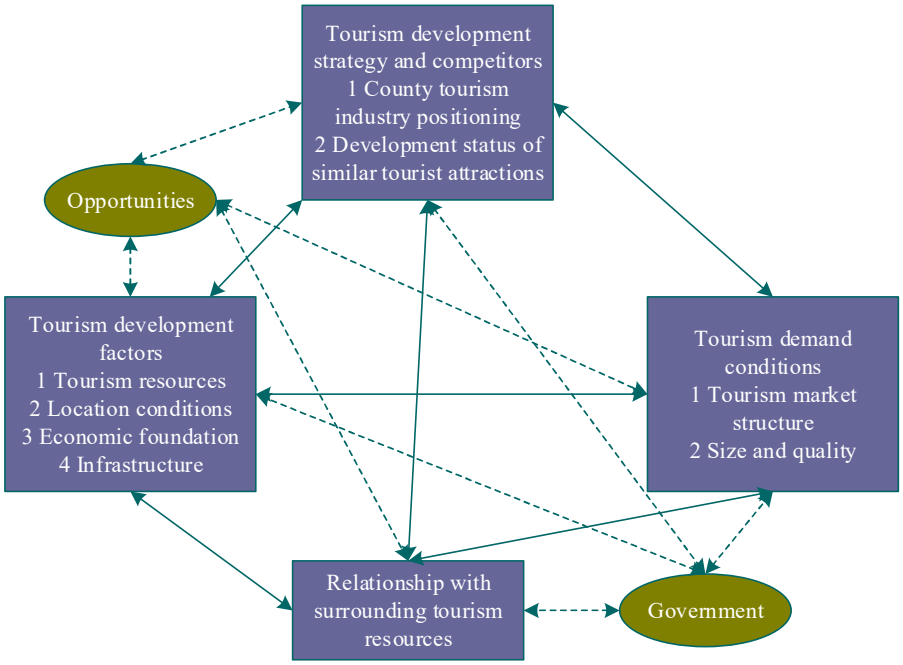


Figure 1: Porter's Diamond Model

III. A. 2) Determination of influencing factors

(1) Tourism Resources

Tourism resources are the source and foundation of modern tourism economic development. Without tourism resources, tourism cannot be developed, people cannot participate in tourism activities, and tourism enterprises cannot attract customers. Tourism resources are rich and diverse, and any resource that can attract tourists can become a tourism resource.

(2) Economic Foundation

The modern economic foundation serves as the material guarantee for the development of modern tourism. During the initial stages of tourism development, significant capital investments are required for the infrastructure needed to support such development. Generally, the modern economic foundation and modern tourism development exhibit a characteristic of synchronous development.

(3) Location Conditions

Here, location conditions primarily refer to geographical location conditions. Geographical location conditions not only influence the scale of the tourism market but also affect the types and quality of tourism resources. At times, location conditions also emphasize transportation conditions within a region, as transportation conditions are equally a standard for measuring the level of tourism development.

(4) Infrastructure

Infrastructure directly impacts the development of modern tourism economics. The level of infrastructure directly reflects tourism reception capacity and influences tourism investment promotion efforts and standards, thereby affecting the scale and level of modern tourism development.

(5) Market Demand

There must be a market for production. To develop tourism, there must be a source market. The types and scale of tourism product development are influenced by the source market. In other words, modern tourism development must be based on market demand to develop specific tourism products.

(6) Government Behavior

The role of government behavior in county-level tourism economic development cannot be overlooked. Differences in the level of county-level economic development and tourism economic development determine the degree of government intervention in tourism economic development. In economically developed regions,

government intervention is minimal, while in economically underdeveloped counties, where infrastructure is inadequate, investment promotion must be achieved through government behavior.

(7) Relationship with Surrounding Tourism Resources

When developing tourism, one must not only consider one's own tourism resources but also the relationship with surrounding tourism resources, including similar and substitute relationships. Similar tourism resources may inhibit tourism development, while substitute resources may promote it.

(8) Tourism Industry Positioning

The positioning of the modern tourism industry refers to the formulation of modern tourism development goals. The positioning of the tourism industry also influences the selection of modern tourism economic development models.

(9) Development Status of Homogeneous Scenic Areas

Homogeneous scenic areas refer to scenic areas with similar tourism resources. The development status of homogeneous scenic areas can provide references and insights for tourism development and planning.

(10) Opportunities

Opportunities are also a crucial factor in selecting tourism economic development models. They take various forms, such as changes in national policies or shifts in market demand. These opportunities are typically beyond the control of tourism economic development.

III. B. Data Sources

To determine the extent to which these 10 factors influence the development model of county-level tourism, based on the research conducted in the first part of this study, the author invited 20 experts with deep expertise in modern economics and modern tourism economics to evaluate these factors through a questionnaire. Following conventional practice, this paper categorizes the extent to which each factor influences county-level tourism development into five levels: very high (corresponding to a score of 5), high (corresponding to a score of 4), moderate (corresponding to a score of 3), low (corresponding to a score of 2), and very low (corresponding to a score of 1).

III. C. Data Analysis Methods

III. C. 1) Correlation Analysis

Correlation analysis can describe the degree of correlation between variables. Correlation coefficients are a more traditional analytical method, including three types: Pearson correlation coefficient, Spearman correlation coefficient, and Kendall correlation coefficient. Among these, the Pearson correlation coefficient reflects the degree of linear correlation between two variables. However, when variables exhibit non-linear relationships, the Spearman correlation coefficient and Kendall correlation coefficient are generally more appropriate than the Pearson correlation coefficient. Given the content of this study, the Pearson correlation coefficient is adopted here. The correlation coefficients include (1) Pearson correlation coefficient, (2) Spearman correlation coefficient, and (3) Kendall correlation coefficient. These three correlation coefficients all reflect the direction and degree of change between two variables, with values ranging from -1 to 1. The closer $|r|$ is to 1, the higher the correlation. The closer it is to 0, the lower the correlation. -1 indicates perfect negative correlation, 0 indicates no correlation, and 1 indicates perfect linear positive correlation [32]. The Pearson correlation coefficient is used to measure the correlation between variables X and Y, and its formula is:

$$\rho_{X,Y} = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E\left[(X-\mu_X)(Y-\mu_Y)\right]}{\sigma_X \sigma_Y} \tag{1}$$

In the formula, $\operatorname{cov}(X,Y)$ is the covariance of X and Y, σ_X is the standard deviation of X, and μ_X is the expected value $E(X)$ of X. The formula for calculating the standard deviation of X is:

$$\sigma_X = E\left[(X-E(X))^2\right] = E(X^2) - (E(X))^2 \tag{2}$$

Furthermore,

$$E[(X-E(X))(Y-E(Y))] = E(XY) - E(X)E(Y) \tag{3}$$

Therefore, equation (1) can be expressed as:

$$\rho_{X,Y} = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - (E(X))^2}\sqrt{E(Y^2) - (E(Y))^2}} \tag{4}$$

The Pearson correlation coefficient can be understood as the cosine of the angle between two sets of data vectors. A value of ρ close to 0 indicates no correlation, while a value close to -1 or 1 indicates a stronger correlation. A

value of $|\rho| \in [0.8,1]$ indicates a very strong correlation, while a value of $|\rho| \in 0.4$ indicates a weak correlation. The main conditions for applying the Pearson correlation coefficient are as follows:

(1) Both variables are continuous variables.

(2) Both variables follow a normal distribution or a unimodal symmetric distribution close to normal.

(3) There should be a linear relationship between the two variables.

However, the Pearson correlation coefficient also has certain drawbacks, primarily:

(1) The Pearson correlation coefficient is influenced by the distribution of variables and is highly sensitive to outliers. Statistical inferences based on the correlation coefficient are highly sensitive to the type of data distribution.

(2) The denominator of the Pearson correlation coefficient is the standard deviation of the variables. If the variables do not vary, i.e., the standard deviation is 0, then the Pearson correlation coefficient cannot be used to determine whether there is a correlation between this variable and another variable.

III. C. 2) Regression Analysis

Regression analysis is an effective method for exploring the correlation and dependence between variables. The overall regression model reflects the overall trend of the relationship between variables. The linear overall regression model is simple in form and relatively easy to estimate and test parameters, making it a common overall regression model [33].

The general form of the multiple linear regression model is:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \mu_i \ (i = 1,2,\cdots,n) \tag{5}$$

In this model, Y is the dependent variable, $X_1, X_2, \cdots, X_k$ are the independent variables, $\beta_0, \beta_1, \beta_2, \cdots, \beta_k$ are the estimated parameters (regression coefficients), μ is the random error term, k is the number of independent variables, and i is the index of the observation. n is the sample size.

When fitting a multiple linear regression, the linear or approximate linear relationships among the independent variables can lead to the significance of latent variables, increase the variance of parameter estimates, and result in an unstable model. Therefore, the method for diagnosing multicollinearity involves analyzing the matrix $X^T X$ formed by the observed data of the independent variables and using various indicators that reflect the multicollinearity among the independent variables. Common statistical measures for multicollinearity diagnosis include variance inflation factor, conditional index, and variance ratio.

Currently, the most commonly used formal diagnostic method for multicollinearity is the variance inflation factor. The variance inflation factor of the independent variable x_j is denoted as VIF_j, and its calculation method is:

$$VIF_j = \left(1 - R_j^2\right)^{-1} \tag{6}$$

R_j^2 is the multiple coefficient of determination when x_j is the dependent variable and the other independent variables are regressed.

It is generally believed that if $VIF_j > 10$, it indicates that there is strong collinearity in the model, which will seriously affect the least squares estimate. In fact, if:

$$VIF_j = \left(1 - R_j^2\right)^{-1} > 10 \tag{7}$$

Available:

$$\left(1 - R_j^2\right) < 0.1 \tag{8}$$

That is:

$$R_j^2 > 0.9 \tag{9}$$

It is evident that after calculating the variance inflation factors for all variables, if the largest variance inflation factor is greater than 10, it indicates that the corresponding independent variable has a repeatability coefficient higher than 0.9 when performing linear regression analysis with other independent variables. In this case, it can be considered that the independent variable is an approximate linear combination of other independent variables, meaning that there is a high degree of correlation between the independent variables.

IV. Empirical Research Analysis

IV. A. Descriptive statistical analysis and correlation analysis

IV. A. 1) Descriptive statistical analysis

This section conducts a descriptive statistical analysis of the 10 influencing factors mentioned in Section 3.1.2 regarding the innovative growth model of modern tourism economics under the context of digital transformation. The sample size, mean, standard deviation, minimum value, and maximum value of each influencing factor are

statistically analyzed to produce the following table. The results of the descriptive statistical analysis are shown in Table 1. The data shows that the mean values for tourism resources, economic foundation, geographical location, infrastructure, market demand, government behavior, relationship with surrounding tourism resources, tourism industry positioning, development status of homogeneous tourist attractions, and opportunities are 3.186, 3.515, 3.995, 3.729, 3.098, 3.859, 3.661, 3.389, 3.247, 3.196, respectively. The corresponding standard deviation values are 0.434, 0.437, 0.306, 0.462, 0.356, 0.316, 0.439, 0.397, 0.481, and 0.501, respectively. Based on the mean values, it can be concluded that location conditions (3.995) >Government Behavior (3.859) >Infrastructure (3.729) >Relationship with Surrounding Tourism Resources (3.661) >Economic Foundation (3.515) >Tourism Industry Positioning (3.389) >Development Status of Homogeneous Scenic Areas (3.247) >Opportunities (3.196) >Tourism Resources (3.186) >Market Demand (3.098). The numerical values of the 10 influencing factors of the innovative model for modern tourism economic growth under the backdrop of digital transformation are generally at a high level, illustrating the basic distribution of the numerical values of the 10 influencing factors of the innovative model for modern tourism economic growth under the backdrop of digital transformation.

Table 1: Descriptive statistical analysis results

Influencing factors	N	Mean	Standard deviation	Min	Max	Rank
Tourism resources	20	3.186	0.434	1	5	9
Economic foundation	20	3.515	0.437	1	5	5
Location conditions	20	3.995	0.306	1	5	1
Infrastructure	20	3.729	0.462	1	5	3
Market demand	20	3.098	0.356	1	5	10
Government actions	20	3.859	0.316	1	5	2
The relationship with the surrounding tourism resources	20	3.661	0.439	1	5	4
Positioning of the tourism industry	20	3.389	0.397	1	5	6
The development status of homogeneous scenic spots	20	3.247	0.481	1	5	7
Opportunity	20	3.196	0.501	1	5	8

IV. A. 2) Correlation Analysis

Based on the descriptive statistical analysis results of the 10 influencing factors of the innovative growth model of modern tourism economy under the aforementioned digital transformation context, Pearson correlation was used to conduct correlation tests on the influencing factors. The results of the correlation tests are shown in Table 2, where X1 to X10 represent tourism resources, economic foundation, location conditions, infrastructure, market demand, government behavior, relationship with surrounding tourism resources, tourism industry positioning, development status of homogeneous tourist attractions, and opportunities, respectively. Based on the values in the table, the significance values of X1 to X10 are less than 0.05, indicating that the 10 influencing factors of the innovative model for modern tourism economic growth under the backdrop of digital transformation meet the research requirements and do not need to be modified or addressed.

Table 2: The results of the correlation test analysis

Index		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	Pearson	1	0.494	0.537	0.326	0.51	0.566	0.442	0.398	0.332	0.359
	Sig.		0.008	0.006	0.004	0.009	0.002	0.009	0.006	0.002	0.006
	N	20	20	20	20	20	20	20	20	20	20
X2	Pearson	0.494	1	0.48	0.551	0.458	0.36	0.306	0.55	0.423	0.564
	Sig.	0.008		0.005	0.006	0.008	0.005	0.005	0.007	0.009	0.007
	N	20	20	20	20	20	20	20	20	20	20
X3	Pearson	0.537	0.48	1	0.557	0.331	0.548	0.58	0.344	0.588	0.559
	Sig.	0.006	0.005		0.001	0.003	0.007	0.001	0.003	0.003	0.008
	N	20	20	20	20	20	20	20	20	20	20
X4	Pearson	0.326	0.551	0.557	1	0.43	0.546	0.328	0.486	0.569	0.446
	Sig.	0.004	0.006	0.001		0.003	0.005	0.008	0.001	0.008	0.008
	N	20	20	20	20	20	20	20	20	20	20
X5	Pearson	0.51	0.458	0.331	0.43	1	0.435	0.518	0.439	0.412	0.37
	Sig.	0.009	0.008	0.003	0.003		0.005	0.008	0.007	0.002	0.008
	N	20	20	20	20	20	20	20	20	20	20
X6	Pearson	0.566	0.36	0.548	0.546	0.435	1	0.587	0.499	0.325	0.511

	Sig.	0.002	0.005	0.007	0.005	0.005		0.004	0.004	0.008	0.009
	N	20	20	20	20	20	20	20	20	20	20
X7	Pearson	0.442	0.306	0.58	0.328	0.518	0.587	1	0.368	0.481	0.423
	Sig.	0.009	0.005	0.001	0.008	0.008	0.004		0.007	0.002	0.005
	N	20	20	20	20	20	20	20	20	20	20
X8	Pearson	0.398	0.55	0.344	0.486	0.439	0.499	0.368	1	0.391	0.341
	Sig.	0.006	0.007	0.003	0.001	0.007	0.004	0.007		0.007	0.001
	N	20	20	20	20	20	20	20	20	20	20
X9	Pearson	0.332	0.423	0.588	0.569	0.412	0.325	0.481	0.391	1	0.431
	Sig.	0.002	0.009	0.003	0.008	0.002	0.008	0.002	0.007		0.006
	N	20	20	20	20	20	20	20	20	20	20
X10	Pearson	0.359	0.564	0.559	0.446	0.37	0.511	0.423	0.341	0.431	1
	Sig.	0.006	0.007	0.008	0.008	0.008	0.009	0.005	0.001	0.006	
	N	20	20	20	20	20	20	20	20	20	20

IV. B. Regression Analysis

In the context of digital transformation, the 10 influencing factors of the innovative model for modern tourism economic growth were set as independent variables, while tourism economic growth was set as the dependent variable. Using the aforementioned multiple regression model, an exploratory analysis was conducted to examine the relationships among the influencing factors of the innovative model for modern tourism economic growth. The results of the regression analysis are shown in Table 3. The results show that tourism economic growth = 0.0142 + 0.0571 × tourism resources + 0.0684 × economic foundation + 0.0579 × location conditions + 0.0512 × infrastructure + 0.0569 × Market Demand + 0.0697 × Government Behavior + 0.0545 × Relationship with Surrounding Tourism Resources + 0.0531 × Tourism Industry Positioning + 0.0657 × Development Status of Homogeneous Scenic Areas + 0.0639 × Opportunity, which are significantly correlated at the 5% level, and there is no multicollinearity (VIF < 10).

Table 3: Regression analysis results

Model	Non-standardized coefficient		Standard coefficient	T-Value	Sig.	VIF
	B	Standard error	Beta			
Constant	0.0142	0.0047		1.3821	0.004	2.8796
X1	0.0571	0.0051	0.0513	2.1196	0.006	2.176
X2	0.0684	0.0082	0.0644	2.7367	0.003	2.5498
X3	0.0579	0.0046	0.0582	3.4697	0.005	2.1862
X4	0.0512	0.0081	0.0553	3.9882	0.006	2.8301
X5	0.0569	0.0066	0.0516	3.9978	0.004	2.8975
X6	0.0697	0.0047	0.0539	3.2914	0.005	1.81
X7	0.0545	0.0064	0.0567	2.2212	0.009	1.4726
X8	0.0531	0.0026	0.0609	1.3795	0.008	2.9028
X9	0.0657	0.0079	0.0581	2.14	0.002	2.2807
X10	0.0639	0.0046	0.0677	2.8382	0.006	1.9833

IV. C. Spatial Effect Analysis

Based on the analysis above, we can see the relationship between the influencing factors of the modern tourism economic growth innovation model. Considering the existence of spatial effects, we use spatial weight matrices, Moran's index, stationarity tests, unit root tests, and spatial econometric models to explore the spatial effects of the modern tourism economic growth innovation model. Details are as follows:

IV. C. 1) Establishment of the spatial weight matrix

In order to better analyze the spatial spillover effects of innovative models of modern tourism economic growth and understand the degree of interaction and interdependence under different spatial conditions, it is necessary to incorporate spatial weight coefficients when establishing spatial econometric models. Therefore, it is essential to determine a spatial weight matrix suitable for the region. The spatial weight matrix is based on spatial cross-sectional data. When studying spatial panel data, it is necessary to convert the spatial cross-sectional weight matrix into a spatial panel weight matrix. Its expression is as follows:

$$W = w \times diag\left(\frac{\bar{y}_1}{\bar{y}}, \frac{\bar{y}_2}{\bar{y}}, \frac{\bar{y}_2}{\bar{y}}, \cdots, \frac{\bar{y}_n}{\bar{y}}\right) \tag{10}$$

Among them, w represents the first-order adjacency matrix, $\overline{y}_1, \overline{y}_2, \cdots \overline{y}_n$ represents the average tourism economic development level of n regions in year t, and $\overline{y}$ represents the average tourism economic level of the study region as a whole within a certain period of time.

IV. C. 2) Spatial autocorrelation analysis

Whether interregional tourism innovation is relevant and whether there are spillover effects are prerequisites and thresholds for conducting spatial econometric analysis. Based on Open-GeoDa software, Moran's I analysis of spatial autocorrelation and Moran's I analysis of local autocorrelation were conducted to examine the spatial correlation of tourism innovation. The formula for spatial autocorrelation analysis is as follows:

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\left(x_i - \overline{x}\right)\left(x_j - \overline{x}\right)}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \tag{11}$$

$$S^2 = \frac{1}{n}\sum_{i=1}^{n}\left(x_i - \overline{x}\right) \tag{12}$$

$$\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{13}$$

In this context, n represents the sample size, x denotes the test variable, $\overline{x}$ is its mean, x_i and x_j specify the spatial positions at points i and j respectively, and w_{ij} is the spatial weight matrix. The spatial weight matrix is used to measure the closeness of the spatial relationship between variables, and generating the spatial weight matrix is an important step in spatial econometric analysis. This paper adopts a 0-1 spatial weight matrix and selects “Rook contiguity” to generate the weight matrix. Two regions are considered adjacent if they share a common boundary, i.e., adjacent $w_{ij} = 1$ and non-adjacent $w_{ij} = 0$.

(1) Data sources

The research data is sourced from the “Modern Tourism Industry Economic Statistics Yearbook” and provides data support for the spatial effects of the modern tourism economic growth innovation model described below.

(2) Global spatial correlation test analysis

To analyze the spatial spillover effects of the modern tourism economy, it is first necessary to test whether spatial correlation exists between regions. Only when spatial correlation is present can a model with spatial effects be established for further analysis. This study employs the global Moran's I test to examine global spatial correlation based on annual per capita total tourism revenue. Prior to testing, the spatial weight matrix is row-normalized. The test results are shown in Table 4. The results show that the global Moran's I values for the modern tourism economy are all positive and greater than 0, with p-values all less than 0.05. This indicates that there is a strong positive spatial correlation at the 5% significance level, reflecting the existence of agglomeration phenomena in the modern tourism economy.

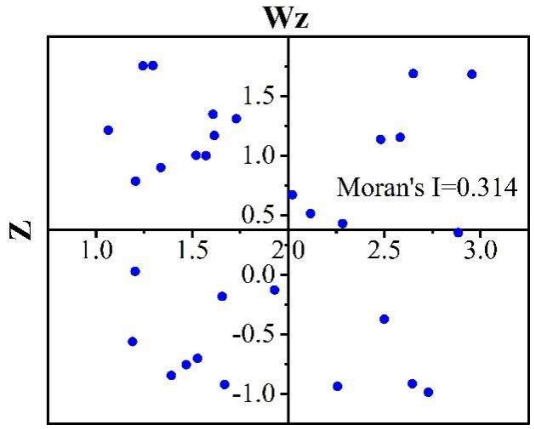
Table 4: Global spatial correlation test and analysis

Year	Moran's I	Mean(I)	SD(I)	Z	P-value
2013	0.314	-0.054	0.148	2.446	0.007
2014	0.346	-0.054	0.149	2.607	0.003
2015	0.248	-0.054	0.148	2.008	0.008
2016	0.227	-0.054	0.147	1.843	0.003
2017	0.209	-0.054	0.147	1.749	0.004
2018	0.216	-0.054	0.146	1.816	0.005
2019	0.236	-0.054	0.146	1.934	0.004
2020	0.188	-0.054	0.147	1.636	0.008
2021	0.211	-0.054	0.147	1.652	0.002
2022	0.187	-0.054	0.146	1.626	0.002

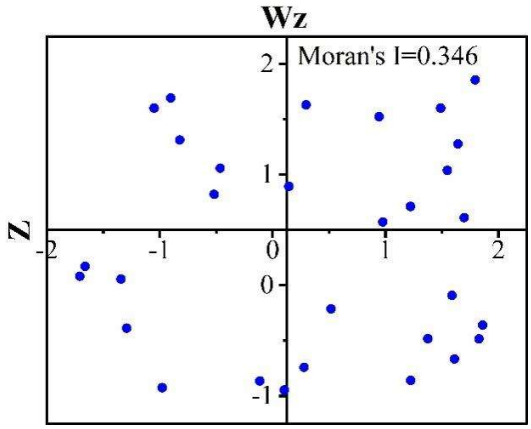
(3) Local Spatial Correlation Test Analysis

From the global Moran's I index values, the tourism economy of a certain region as a whole exhibits spatial correlation. However, regarding whether the tourism economies of the 30 counties within a certain region exhibit

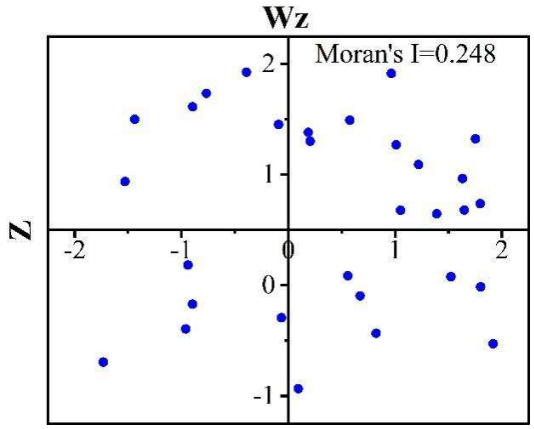
spatial correlation, the local spatial correlation test analysis is shown in Figure 2. where (a) to (j) represent the years 2013 to 2022, respectively. Taking 2013 as an example, it was found that the tourism economies of most of the 30 counties in the region were located in the second and third phenomena, indicating that the tourism economies of the 30 counties in the region exhibit significant positive and negative spatial correlation. This positive spatial correlation represents the positive and negative spatial spillover effects. The data for the remaining years from 2014 to 2022 are based on the figures shown in the chart.



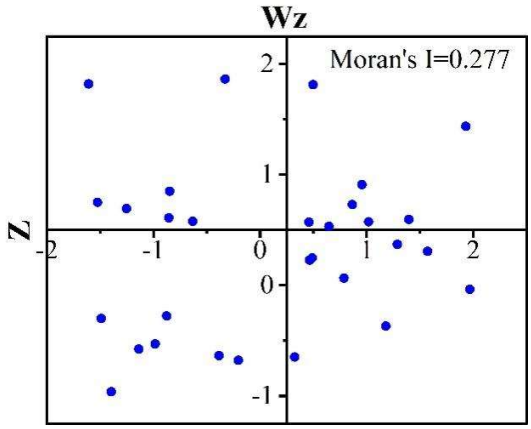
(a) 2013



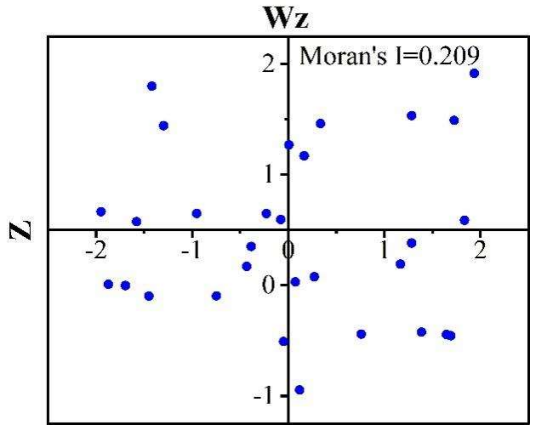
(b) 2014



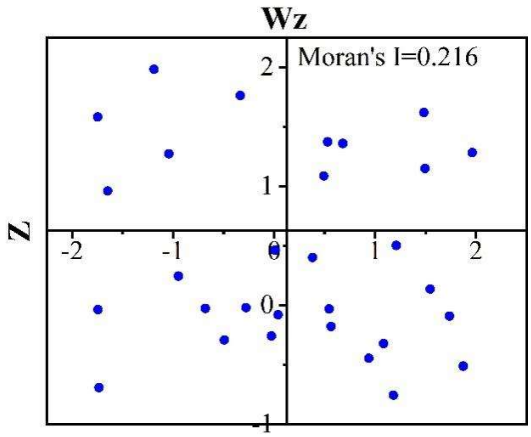
(c) 2015



(d) 2016



(e) 2017



(f) 2018

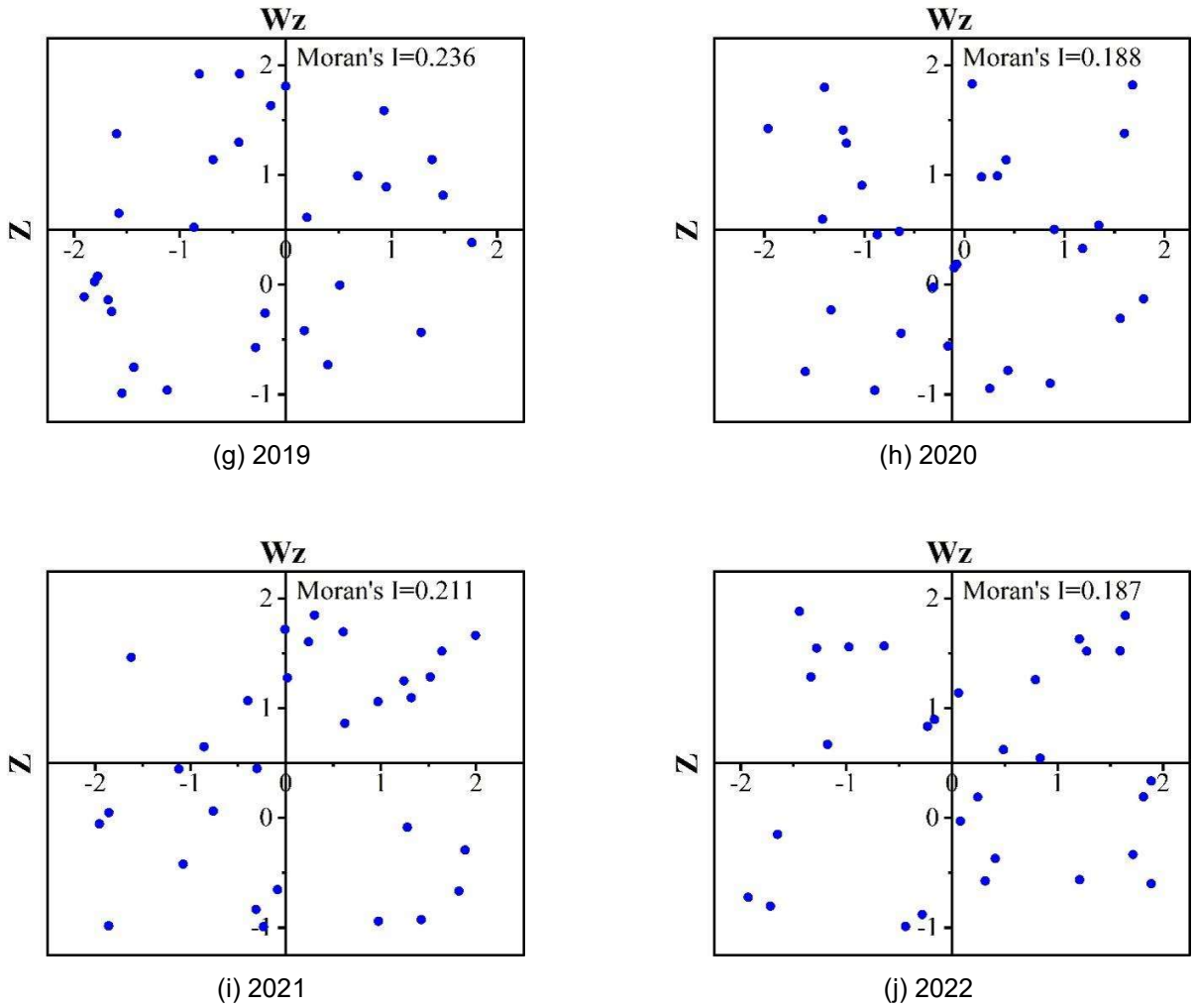


Figure 2: Local spatial correlation test and analysis

IV. C. 3) Stability test

Figure 3 shows a horizontal sequence diagram. From Figure 3, it can be seen that the changes in the tourism economy and digitalization level from 2013 to 2022 are non-stationary, but they all show a common upward trend, with both trend and constant terms.

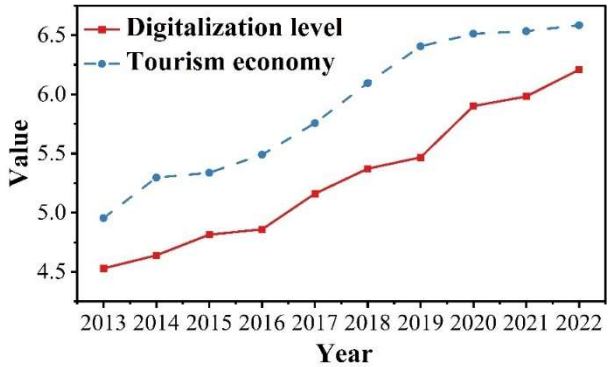


Figure 3: Horizontal sequence diagram

Next, we conducted a first-order difference sequence test on the data, as shown in Figure 4. The figure shows that the tourism economy and digitalization level still exhibit non-stationarity in the period from 2013 to 2022, with no trend and a constant term. We continued to conduct second-order difference sequence tests until the image became stationary.

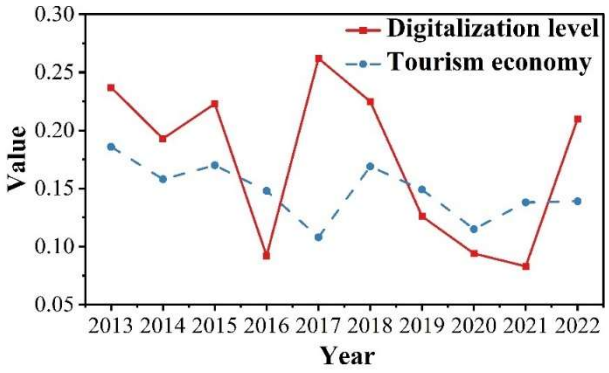


Figure 4: The first difference sequence diagram

Next, we conducted a second-order difference sequence test on the data, as shown in Figure 5. From the figure, it can be seen that the changes in the tourism economy and digitalization level from 2013 to 2022 may be a stationary sequence with no trend, fluctuating around 0, indicating that there is no constant term. However, to determine whether the second-order difference sequence is stationary, further unit root tests are required.

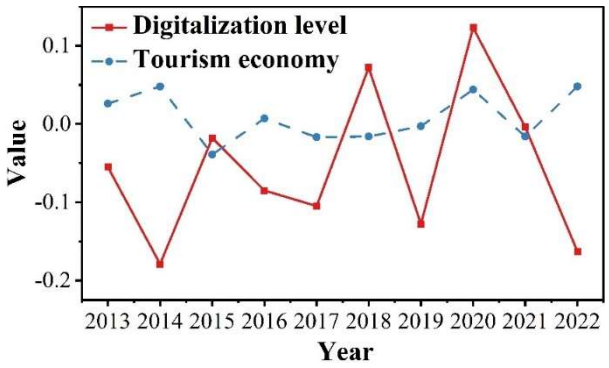


Figure 5: Second-order difference sequence diagram

IV. C. 4) Unit root test

The ADF unit root test method was selected. Based on the time series chart of the level sequence, it was observed that there was a time trend and a constant term. Therefore, when testing the level sequence, it was determined to select a method with a time trend and a constant term. When conducting the first-order difference unit root test, based on the chart, a method without a time trend and with a constant term was selected. When conducting the second-order difference test, based on the chart, a method without a time trend and with a constant term was selected. The test results are shown in Table 5. The unit root test report indicates that the two level sequences are non-stationary. Among the two first-order difference sequences, the tourism economy is non-stationary at the 10% significance level, while the digitalization level is stationary at the 10% significance level. In further unit root tests, the two second-order difference sequences, tourism economy and digitalization level, are stationary at the 10% and 1% significance levels, respectively. Therefore, both tourism economy and digitalization level are second-order integral I(2) sequences, passing the unit root test, and can be further tested for long-term spatial correlation between them.

Table 5: ADF unit root test method

Variable		ADF statistical values	1% critical value	5% critical value	10% critical value	Conclusion
Original	Tourism economy	-2.607	-5.516	-4.103	-3.508	Non-stationary
	Digitalization level	-1.931	-5.248	-4.004	-3.433	Non-stationary

First-order difference	Tourism economy	-2.029	-4.541	-3.315	-2.751	Non-stationary
	Digitalization level	-3.226	4.411	-3.228	-2.736	Non-stationary
Second-order difference	Tourism economy	-1.906	-2.919	-2.012	-1.549	Stable
	Digitalization level	-5.215	-2.843	-1.948	-1.548	Stable

IV. C. 5) Spatial effect analysis based on spatial econometric models

Based on the analysis and verification discussed above, it can be concluded that the innovative model of modern tourism economic growth under the backdrop of digital transformation exhibits spatial effects. To this end, the spatial autoregressive (SAR) model within spatial econometric models is employed to conduct an in-depth analysis of the spatial effects inherent in the innovative model of modern tourism economic growth. Spatial panel SAR model:

$$Y_{it} = \rho W Y_{it} + X_{it}\beta_1 + W X_{jt} + \varepsilon_{it}, \varepsilon_{it}\left(0, \sigma_{it}^2\right) \tag{14}$$

X represents the 10 influencing factors of the modern tourism economic growth innovation model, Y_{it} represents the spatial utility value of the tourism economy, β represents the regression coefficient, and ε represents the disturbance term.

The results of the spatial panel Durbin model regression are shown in Table 6. The results indicate that the 10 influencing factors of the innovative model for modern tourism economic growth exhibit spatial correlation at the 5% level, and this correlation is positive spatial correlation. The goodness-of-fit is 0.824, indicating that the spatial Durbin model explains 82.4% of the influence of the factors on the innovative model for modern tourism economic growth. The quantitative explanation of the specific correlation is that when the tourism resources of an adjacent region increase by 1 unit, the tourism economic growth of the current region increases by 0.0628 units, and the same applies to the other 9 variables.

Table 6: Regression results of the spatial panel Durbin model

Variable	Regression coefficient	Standard deviation
X1	0.0628**	0.0113
X2	0.0851**	0.017
X3	0.0534**	0.0153
X4	0.0831**	0.0172
X5	0.0817**	0.0194
X6	0.0812**	0.0122
X7	0.0634**	0.0145
X8	0.0863**	0.0163
X9	0.051**	0.0199
X10	0.0583**	0.0116
Goodness of fit	0.824	

According to the results of the spatial panel Debin model regression, the direct effects, spillover effects, or total effects of each explanatory variable on the tourism economy are shown in Table 7. The data indicate that when the tourism resources of an adjacent region increase by one unit, the tourism economy of the local region grows by 0.0802 units. The same logic applies to the remaining nine variables. This fully explains the spatial effects of the influencing factors in the innovative model of modern tourism economic growth and demonstrates that this model can reveal the development trends of modern tourism economies, providing important guidance for enhancing the economic development of the tourism industry.

Table 7: Spatial effect analysis results

Variable	Direct effect	Spillover effect	Overall effect
X1	0.0581**	0.0221**	0.0802**
X2	0.0503**	0.0209**	0.0712**
X3	0.0556**	0.0211**	0.0767**
X4	0.0561**	0.0266**	0.0827**
X5	0.0537**	0.0247**	0.0784**
X6	0.0571**	0.023**	0.0801**
X7	0.0553**	0.0286**	0.0839**

X8	0.055**	0.0218**	0.0768**
X9	0.0531**	0.0247**	0.0778**
X10	0.0596**	0.0295**	0.0891**

V. Conclusion

This paper addresses the issues in the current modern tourism economic model by designing an innovative growth model for modern tourism economics from three perspectives. To validate whether this model can uncover the current issues in tourism economic development, an empirical research plan for the innovative growth model of tourism economics has been formulated. Based on relevant data and actual circumstances, 10 influencing factors are selected as research variables. Pearson correlation coefficients and multiple linear regression models are employed as primary data analysis methods. Under the guidance of this research plan, an empirical analysis of the innovative model for modern tourism economic growth is conducted. The regression equation for the innovative model for modern tourism economic growth is derived as: 0.0142 + 0.0571* tourism resources + 0.0684 × economic foundation + 0.0579 × location conditions + 0.0512 × infrastructure + 0.0569 × market demand + 0.0697 × government behavior + 0.0545 × relationship with surrounding tourism resources + 0.0531 × tourism industry positioning + 0.0657 × development status of homogeneous tourist attractions + 0.0639 × opportunities. Using a spatial weight matrix, Moran's index, stationarity tests, and unit root tests, the study detected the presence of spatial effects in the tourism economy. A spatial panel autoregressive (SPAD) model was then employed to analyze the spatial effects of the innovative growth model of the modern tourism economy. When the tourism resources of an adjacent region increase by one unit, the tourism economy of the current region grows by 0.0802 units, illustrating the spatial effects of the innovative growth model of the modern tourism economy. This finding holds significant implications for enhancing regional tourism economies.

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