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Spatiotemporal Coupling Factors and Mode of Tourism Industry, Urbanization and Ecological Environment: A Case Study of Shaanxi, China

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Received: 9 August 2019; Accepted: 6 September 2019; Published: 9 September 2019



Abstract: Identifying the factors and patterns of coordinated development in the tourism industry, urbanization, and the ecological environment sheds light on how to ensure the high-quality and sustainable development of the regional economy, but the research on this issue is relatively insufficient. Taking Shaanxi Province as an example, this paper analyzes the spatiotemporal coupling characteristics between the tourism industry, urbanization and ecological environment in cities of Shaanxi Province from 2000 to 2017. After identifying the leading factors of coupling of the three systems, the paper summarizes the coupling development mode in each city under the leading factors. The coupling between the tourism industry, urbanization and ecological environment in various cities has realized the fundamental transformation from incoordination to coordination and finally, formed a spatial development pattern featuring strong central regions, and weak southern and northern regions. Before 2010, ecological environment factors dominated the coupling between the tourism industry, urbanization, and ecological environment in Shaanxi's cities, while after 2010, urbanization and tourism industry gradually became the leading factors of the coupling development of the three systems. The coupling development mode in each city has generally undergone an evolution process of "ecological environment mode–urbanization mode–tourism industry mode". A coupling development mode dominated by urbanization has formed in cities in Northern Shaanxi, a coupling development mode dominated by mixed urbanization and the tourism industry has formed in the Guanzhong Region, and a coupling development mode dominated by the tourism industry has formed in cities in Southern Shaanxi. This paper provides theoretical and practical references for promoting the precise macro-control of cities and guaranteeing the high-quality development of the regional economy.

Keywords: tourism industry; urbanization; ecological environment; coupling factors; coupling mode

1. Introduction

China's economy has entered an era of high-quality development. Tourism and urbanization have become the driving forces behind economic transformation and development, with the ecological environment being the basis for ensuring high-quality economic development. Exploring the coupling development relationship among tourism industry, urbanization and ecological environment plays an important role in promoting sustainable economic development. The tourism industry has become a strategic pillar industry of China [1], and an important impetus to promote the high-quality development of the regional economy and the adjustment of industrial structure. Cities are important tourist destinations, quality urban services and infrastructure guarantee the smooth progress of

tourism activities, and comprehensiveness and relevance of the tourism industry are conducive to the development of the urban industrial economy. Moreover, tourism has become an important driving force in the improvement of the regional urbanization level [2] as tourism is closely related to urban construction. The ecological environment is the premise of the sustainable development of tourism and urbanization, as well as the basis for ensuring the coordination of social economy and green development [3]. The three systems are closely related. The tourism industry, urbanization, and ecological environment are important components of regional economic development, and it is of great importance to make clear the degree of coordinated development among them in order to ensure the sustainable development of the regional economy. However, at present, there is a lack of research on the leading factors and development mode of the coupling between the tourism industry, urbanization and ecological environment.

The coupling theory is a theory that analyzes the coordination degree and quality of elements between systems or within systems. It mainly measures the coordination degree between different systems or different elements through the coupling degree and coupling coordination degree, in order to investigate the law of the coordinated development between systems [3]. In the analysis, the degree of coupling is mainly used to quantitatively analyze the degree of interaction between systems or elements, while the degree of coupling coordination is to qualitatively represent the degree of coordination between systems or elements [4]. With the coupling theory, the coordination degree and quality between the tourism industry, urbanization, and ecological environment in different stages can be studied. Meanwhile, according to their functional contributions, the key factors leading to the coordinated development of the three systems can be identified. Moreover, the development modes of the three systems in different stages can be summarized, which sheds light on how to precisely carry out the supply-side reform of regional tourism, the quality development of urbanization and the construction of ecological civilization. To provide theoretical and practical references for promoting precise macro-control in all cities and guaranteeing high-quality development of the city economy, Shaanxi Province along the “Belt and Road” is taken as the study case in this paper to explore the coupling degree between the tourism industry, urbanization and ecological environment in different cities in Shaanxi province. The factors leading the coupling development of the three systems in different stages are also identified, and the coupling development modes of the three systems are then summarized.

2. Theoretical Basis and Literature Review

2.1. Coupling Mechanism between the Tourism Industry-Urbanization and Ecological Environment

Coupling refers to the phenomenon that two systems affect each other through interaction, which is embodied in the interactive relationship between systems or system elements. According to the degree of the interactive relationship, it shows two states: good coupling and defective coupling. In a good coupling state, systems or elements cooperate properly and promote mutually, while in a defective coupling state, the relationship between systems or elements is uncoordinated. From the diachronic perspective, the coupling relations between systems or elements all have an interactive evolution between incoordination and coordination [3,4].

The tourism industry, urbanization, and ecological environment, as components of the regional economy, have significant interaction and strong coupling coordination (Figure 1). Firstly, the integration and correlation of the tourism industry can promote urbanization from the aspects of industrial chain extension, employment absorption, and urban image building. Secondly, the development of urbanization provides a potential source market for the development of the tourism industry, improves facilities and services for the development of tourism activities, and provides talents, funds and land support for the development and construction of scenic spots. Thirdly, the ecological environment is the basis and premise between the tourism industry and urbanization. A good ecological environment is an indispensable resource for tourism development and a vital component of destination attraction.

The ecological environment is an essential element for the healthy development of urbanization, and therefore the protection of the ecological environment should be strengthened in the process of urbanization construction.

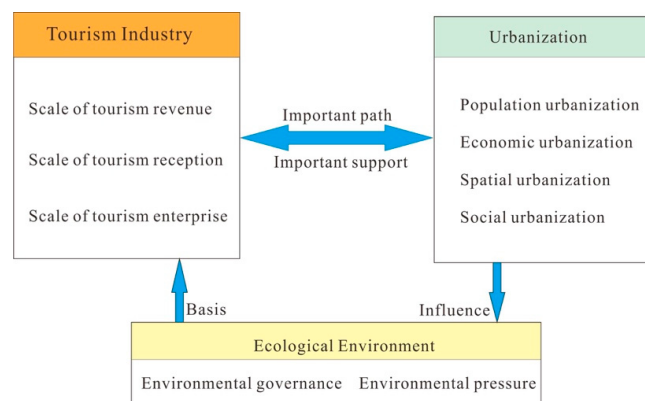


Figure 1. Coupling interaction mechanism between the tourism industry, urbanization, and the ecological environment.

According to the research on whether the tourism industry promotes urbanization development, many research results show that the development of the tourism industry has a positive effect on urbanization. Firstly, tourism has a natural tendency to integration and relevance. With the development trend of personalized tourism consumption, tourism will not only promote the development of urban catering, accommodation, shopping, transportation and entertainment, but also strengthen the integration with manufacturing, industry, agriculture, forestry, etc., and improve and extend the industrial chain of the city. Secondly, the extension of the tourism industry chain raises the employment of the urban population, improves the employment rate of urban tertiary industry, increases the income of urban residents, and promotes the urbanization of China's population. The Yearbook of China Tourism Statistics shows that in 2017, the direct and indirect employment of China's tourism industry reached 79.9 million, accounting for 10.28% of the total employed population [5]. Thirdly, the improvement of the tourism industry chain can drive the adjustment of urban industrial structure, promote industrial agglomeration, form the effects of an urban scale economy, and enhance the strength of urban regional economic development.

Urbanization will actively drive the development of the tourism industry. First, the improvement of urbanization level means the increase in the population of urban residents. In addition, the per capita income of urban residents is relatively high. Therefore, the travel potential of urban population is relatively strong, and the development of urbanization provides a huge existing and potential source market for the development of tourism [2]. Secondly, urbanization drives the construction of basic service facilities such as transportation, communication, medical care, and security, providing auxiliary support for the development of the tourism industry. Thirdly, urbanization improves residents' educational level, which can provide personnel support for the development of the tourism industry and enhance the competitiveness of the tourism industry [3].

The development of the tourism industry has a certain negative impact on the ecological environment, but the positive impact of the tourism industry is much stronger than the negative impact. Firstly, the development of the tourism industry provides financial support for the protection and construction of ecological and environmental resources. Secondly, the development of the tourism industry will transform the ecological environment into tourism resources and promote the rational development and utilization of ecological resources. Thirdly, the development of the tourism industry can provide funds and technical investment for ecological environment control, to eliminate the damage and pollution brought by tourism development to the ecological environment.

The ecological environment is the basis and premise between the tourism industry and urbanization. Firstly, a good ecological environment is also an important part of urbanization, as the urban green

coverage rate and green area are important indicators of urbanization construction. Secondly, the ecological environment is the resource carrier for regional tourism development, since the construction of scenic spots needs the support of a beautiful ecological environment to support. Thirdly, the quality of the ecological environment will either promote or threaten the development of the tourism industry and urbanization.

To sum up, the tourism industry, urbanization and ecological environment are important factors of regional development, and there is a close interactive coupling relationship between them. It is of great significance to realize the sustainable and green development of the regional economy to deeply analyze the degree of coupling coordinated development between the three systems, explore the factors of coupling coordination of them, and summarize the coupling development mode of them.

2.2. Coupling between Tourism Industry and Urbanization

In the research on the coupling between the tourism industry and urbanization, most scholars focus on the interactive relationship, coordination degree and spatial differences between the tourism industry and urbanization in different provinces or cities from the perspective of time and space. Mullins P believes that the tourism industry is an important driving force for urbanization and will promote the emergence of tourism urbanization [6]. Murphy believes that by actively developing the tourism industry, cities can improve the diversity of urban industrial sectors and optimize the urban industrial structure [7]. Min Yin believes that the rapid increase of population urbanization and the rapid development of tourism will surpass the environmental carrying capacity of the city, which is conducive to the sustainable development of regional tourism [8]. Wei Tang found through empirical analysis that the development of tourism plays an important role in promoting urban expansion in the east and south of Lhasa [9]. Akama found that only by paying attention to the economic, social, and cultural interests of community residents can the coordinated development of urbanization and tourism be guaranteed [10]. Yi Pan found that the development of the tourism industry has driven the increase in the number of urban buildings and the expansion of their area in Zhoushan Islands, but scientific land planning is needed to meet the sustainable development of the city in the future [11]. Gao Nan analyzed the evolution process and characteristics of the coupling between the tourism industry and urbanization in Xi'an and believed that the coupling between the two has achieved the transformation from incoordination to coordination [12]. Zhan Xinhui discussed the level difference and evolution characteristics of the coupling between tourism and urbanization in Shaanxi and believes that the coupling degree between the two systems is constantly improving and has the characteristics of regional clustered distribution [13]. Ma Libang analyzed the coordination degree between tourism industry development and urbanization in county-level cities in Northwest China against the background of new type urbanization and believed that the cultural tourism-oriented mode is a good mode suitable for urban development in Northwest China [14].

2.3. Coupling between Tourism Industry and Ecological Environment

In the study of coupling between the tourism industry and ecological environment, scholars analyzed the coordination and stress effect between the tourism industry and ecological environmental elements such as parks, forests and islands. Marjo evaluated the supply and demand coordination between the national park tourism industry and ecological environment and believed that tourism development should be positively combined with ecological protection [15]. Zi Tang analyzed the coupling process and regional differences between the tourism industry and ecological environment and found that economic benefits and ecological quality are the key factors affecting the coupling between the tourism industry and ecological environment [16]. Based on the tourism satellite account, Jones et al. analyzed the impacts of different industrial sectors on the ecological environment during the development of the tourism industry [17]. Stroma studied the coordination degree between the tourism industry and the supply and demand of water resources in Paris and found that the environmental pressure and constraints brought by the development of tourism affect the development

of regional economy [18]. Hsin-jung discussed the dynamic coordination relationship between the tourism industry and the ecological environment and its regional differences [19]. Halden and Andrew believes that the development of the tourism industry is closely related to the ecological environment. To reduce the environmental constraints brought by the development of the tourism industry, it is necessary to establish a systematic and powerful ethical system of environmental protection [20]. Elisa M believes that the development of forest tourism has endowed forestry resources with new functions and promoted the development of regional economy in Italy, but the development of tourism also causes pressure on the forest ecological environment [21]. Rahmani A analyzed the carrying capacity of eco-tourism in Hamadan city, believed that the sustainable development of tourism must be maintained within the acceptable limits of the ecological environment, and proposed ways to improve the ecological environment [22]. Fery K analyzed the coordination relationship between the island tourism and ecological environment by employing the coupling index and coordination model and found that tourism development and ecological construction are unbalanced, and ecological environment construction lags behind [23]. Gao Wei-quan fully analyzed the coordination relationship between the tourism industry and ecological environment of the Changshan Islands and believes that ecological factors have become the key to restrict the coupling development between the tourism industry and ecological environment of Changshan Islands [24]. Wang Zhaofeng discussed the coupling relationship and types between the tourism industry and ecological environment in cross-border tourism areas to find that the ecological environment has become a constraint for the development of the regional tourism industry [25].

2.4. Coupling of Tourism Industry-Urbanization-Ecological Environment

In the research on the coupling between the tourism industry, urbanization, and the ecological environment, scholars analyzed the temporal evolution characteristics and spatial differences of coupling of the three systems in the typical areas such as economic belt and urban agglomeration. Gao Yang analyzed the development types and pattern differences of coupling between the tourism industry, urbanization and ecological environment in Beijing-Tianjin-Hebei region, and found that the constraining effect of the ecological environment on the tourism industry and urbanization is increasingly prominent [2]. Nie X Y believes that the coordinated development between the tourism industry and urbanization in Dunhuang plays an important role in urban ecological development and environmental improvement [26]. Hu Zhenpeng investigated the evolution characteristics of the coupling between the tourism industry, urbanization and ecological environment in Poyanghu area, and believes that only the restoration of ecological environment could accelerate the development of tourism and urbanization [27]. Xu Huiyun found that the tourism industry and urbanization in the six provinces in the middle and lower reaches of the Yangtze River are developing rapidly, but the constraining effect of the ecological environment is gradually emerging [28]. Li Xiang thinks that the coupling between the tourism industry, urbanization and ecological environment in the Yangtze River Economic Zone presents a spatial feature of "high in the east and low in the west" [29]. Han Wenyan found that the coupling between the tourism industry, urbanization and ecological environment in the nine provinces and regions along the Silk Road are weak, but has a slowly-rising trend, and the lagging development of the tourism industry is the main factor restricting the coordinated development of the three systems [30].

2.5. Research Review

The tourism industry is an important driving force for promoting urbanization, and the city is the carrier that breeds and grows the tourism industry, while the healthy development of the tourism industry and urbanization must be based on a good ecological environment. Studies on the coupling between the tourism industry, urbanization and ecological environment show the following characteristics. Firstly, in terms of the research content, existing studies have analyzed the coordination degree of the coupling between the tourism industry, urbanization and ecological environment,

as well as its evolution process, spatial difference and development type. However, there is a lack of identification and analysis of the factors affecting the coupling coordination development of the three systems in different development stages. Meanwhile, under the influence of different factors, the summary of the specific development modes of the three systems is insufficient, and the research depth needs to be improved. Secondly, in terms of the research perspective, most researches focus on the analysis of the evolution and pattern of two-dimensional couplings between the tourism industry and urbanization, or the tourism industry and ecological environment, etc. However, there are few studies on the evolution and pattern of the three-dimensional coupling between the tourism industry, urbanization and ecological environment, and the dimension and width of the research perspective need to be expanded. Finally, in terms of regional selection, although existing researches give attention to both macro and micro systems, most of them focus on the developed cities or provinces in eastern China. Under the background of “Belt and Road Initiative” and the Great Western Development Strategy, the research on the coupling coordination between the tourism industry, ecological environment and urbanization in typical western regions of China needs urgent attention.

To sum up, it can be seen that the analysis of the coupling between the tourism industry, urbanization and ecological environment has become a hot spot in the research of regional economic sustainable development. However, the existing research results are insufficient in research depth and dimension, and meanwhile, the research horizon also lacks academic attention to the typical provinces and regions in western China. In view of this situation, this paper takes Shaanxi Province along the “Belt and Road” as the research object in order to study the coupling coordination degree between the tourism industry, ecological environment and urbanization in Shaanxi’s cities, and to identify the influencing factors that dominate the coupling between the three systems in different development stages in each city. Then, through the classification and analysis of the leading factors, the paper summarizes the stage pattern of coupling development in different cities.

Through the analysis of the factors and pattern of the coupling between the tourism industry, urbanization and ecological environment in Shaanxi’s cities, we expect to shed some light on how to precisely promote the supply-side reform of regional tourism industry, the quality development of urbanization and the construction of ecological civilization in practice in Shaanxi’s cities. In theory, we hope to deepen the understanding of the law of coordinated development of the tourism industry, urbanization and ecological environment, and to further enhance and enrich the coupling theory in the research of tourism both in depth and dimension. In practice, through the analysis of coupling factors and development mode of the tourism industry, ecological environment and urbanization in Shaanxi Province, each city shall adopt specific development strategies to ensure the sustainable development of its regional economy according to the differences in leading factors and development modes.

3. Study Area

Shaanxi Province, with an area of 205,800 square kilometers, is the key construction area of China’s “Belt and Road” and Great Western Development Strategy (Figure 2). Shaanxi is high in the north and south and low in the middle, with the Loess Plateau in the north, Guanzhong Plain in the middle and Qinba mountains in the south. The specific cities of Shaanxi Province include the ten prefecture-level cities: Yan’an, Yulin, Tongchuan, Baoji, Xi’an, Weinan, Xianyang, Shangluo, Hanzhong and Ankang. The support for national policies, the geographical location connecting the East and the West, and the climate characteristics with obvious differences between the North and the South highlight Shaanxi as a typical research object. Since the reform and development, Shaanxi Province has made great progress in tourism, urbanization and ecological environment construction.

Tourist economy, hotels, travel agencies and scenic spots in Shaanxi Province are developing rapidly. In 2000, Shaanxi Province received 31 million domestic and overseas tourists, with a total tourism revenue of 15.024 billion yuan. In 2017, Shaanxi Province received 521.84 million domestic and overseas tourists, with a total tourism revenue of 481.4 billion yuan. The number and income of domestic and foreign tourists received in Shaanxi Province in 2017 were 17 times and 32 times

those in 2000 respectively. In 2017, Shaanxi Province had 300 star-rated hotels, 737 travel agencies and 418 A-level scenic spots, which were three times, 3.7 times, and two times those in 2000, respectively. In terms of urbanization, the urban population of Shaanxi Province increased from 9.99 million in 2000 to 21.7815 million in 2017, and the urbanization rate increased from 27.8% in 2000 to 56.79% in 2017. Since 2000, great progress has also been made in ecological protection and construction. The forest coverage rate in Shaanxi Province increased from 24.1% in 2000 to 43.06% in 2017, and the green area of gardens increased from 9079 hectares in 2000 to 67,965 hectares in 2017.

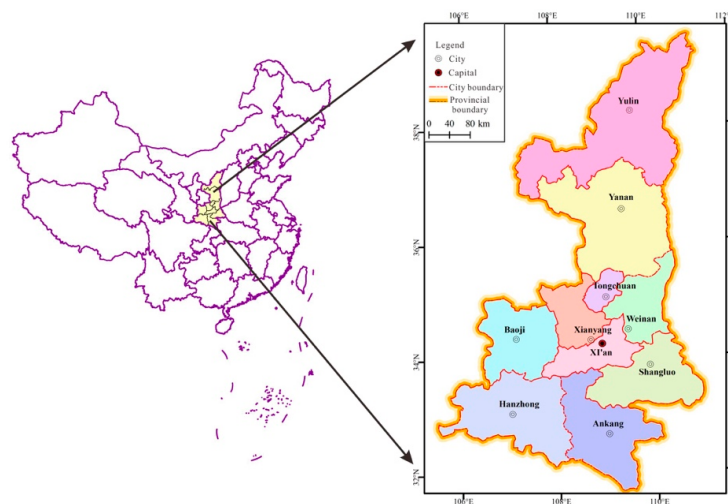


Figure 2. Map of Shaanxi Province.

4. Methods and Data

4.1. Methods

4.1.1. Evaluation Model for Comprehensive Development Level

The linear weighting method [4] is adopted to measure the comprehensive development level of the tourism industry, urbanization and ecological environment in various cities of Shaanxi Province (Equation (1)). In the model, u_i is the comprehensive development level value of the system in the i th year, u_{ij} is the functional contribution of the index j to the system, w_{ij} is the index weight, which is obtained by using the relatively objective entropy weighting method [4].

$$u_i = \sum_{j=1}^n w_{ij} \times u_{ij} \quad (1)$$

The functional contribution u_{ij} , obtained by analyzing each indicator (Equations (2) and (3)) with the positive efficacy function and negative efficacy function [12], is used to evaluate the role and contribution of each index to the system, with the value range of [0–1]. x_{jmax} and x_{jmin} are the maximum and minimum values of the j th index.

$$u_{ij} = (X_{ij} - X_{jmin}) / (X_{jmax} - X_{jmin}) \quad (u_{ij} \text{ is the positive index}) \quad (2)$$

$$u_{ij} = (X_{jmax} - X_{ij}) / (X_{jmax} - X_{jmin}) \quad (u_{ij} \text{ is the negative index}) \quad (3)$$

4.1.2. Evaluation Model for Coupling Degree

Based on the coupling model in physics, and by consulting existing studies [27–31], a coupling degree evaluation model of the tourism industry, urbanization and ecological environment (Equations (4) and (5)) can be constructed. In the model, u_1 , u_2 and u_3 are the comprehensive evaluation

values of the tourism industry, urbanization and ecological environment respectively. C_3 is the coupling degree of the three systems, with $C \in [0,1]$. The higher the value of C is, the higher the coupling degree between the tourism industry, urbanization and ecological environment is. When $C = 1$, the coupling degree is at the highest, which means that the three reach the optimal coupling state, and the system structure evolves from a disordered stage to an ordered state. When $C = 0$, the three systems are in an uncoordinated state, and the system structure shows disordered development.

$$C_n = \{(u_1 \times u_2 \times \cdots \times u_n) / \Pi(u_i + u_j)\}^{1/n} \quad (4)$$

$$C_3 = \{(u_1 \times u_2 \times u_3) / [(u_1 + u_2 + u_3) \times (u_1 + u_2 + u_3) \times (u_1 + u_2 + u_3)]\}^{1/3} \quad (5)$$

4.1.3. Evaluation Model for Coupling Coordination Degree

In the coupling degree model, there may be a false appearance that the system has a low comprehensive development level, but a high coordination degree. Based on existing studies [27–31], a coupling coordination degree model of the tourism industry, urbanization and ecological environment is constructed (Equations (6) and (7)). In the model, D is the coordination degree, C is the coupling degree, and T is the coupling coordination index of the system. The value of coupling coordination degree $D \in [0,1]$, when $D = 0$, the coupling coordination degree is at the lowest, and the systems are uncorrelated. When $D = 1$, the coupling coordination degree is at the highest, and coupling between the systems is optimal. In the Equations, u_1 , u_2 and u_3 respectively represent the comprehensive evaluation values of the tourism industry, urbanization and ecological environment, and α , β and γ are undetermined coefficients. In the coordinated development of the tourism industry, urbanization and ecological environment, the status of tourism industry, ecological environment and urbanization is not equal. The ecological environment is the basis of tourism industry and urbanization; urbanization can provide the tourist market and service facilities for the development of tourism industry; and the tourism industry is the driving force of urbanization, but not the only driving force [27,28]. Considering the status and function degree of the three systems, the undetermined coefficients of the tourism industry, urbanization and ecological environment are determined, where the values of α , β , and γ are 0.2, 0.4 and 0.4, respectively [29–31].

$$D = \sqrt{C \times T} \quad (6)$$

$$T = \alpha u_1 + \beta u_2 + \gamma u_3 \quad (7)$$

4.1.4. Interval Division of Coupling Coordination Degrees

To more scientifically understand the characteristics and laws of coordinated development of tourism industry, urbanization, and the ecological environment, it is necessary to classify the degree of coupling coordination. The coupling coordination degree is mainly evaluated by four methods, namely the “four points method”, “six points method”, “seven points method”, and “ten points method” [2]. According to the “ten points method” divided by the uniform distribution interval method, the evolution process of coupling coordination degree can be described in detail [32]. Therefore, this study adopts the 10-interval method to divide the coupling coordination degree between the tourism industry, ecological environment and urbanization (Table 1).

Table 1. Criteria for evaluating coupling coordination degree.

Coordination Degree (D)	Coordination Level	Coordination Degree (D)	Coordination Level
0.00–0.09	Extreme incoordination	0.50–0.59	Barely coordination
0.10–0.19	Serious incoordination	0.60–0.69	Primary coordination
0.20–0.29	Moderate incoordination	0.70–0.79	Intermediate coordination
0.30–0.39	Mild incoordination	0.80–0.89	Good coordination
0.40–0.49	Close to incoordination	0.90–1.00	Quality coordination

4.2. Evaluation Index

After reviewing the literature on the coupling between the tourism industry, urbanization and ecological environment and consulting experts, combined with the development situation of Shaanxi's regional economy, a coupling evaluation index system of the tourism industry, urbanization and ecological environment of Shaanxi Province is systematically constructed (Table 2). On the basis of referring to the existing literature on the coupling between the tourism industry and urbanization [11–14], the tourism industry and the ecological environment [23–25], and the tourism industry, the ecological environment and urbanization under the principle of scientificity and comprehensiveness [2,26–30]. In the system, the tourism industry indexes contain eight elements, including tourism revenue scale, tourism reception scale, and tourism enterprise scale; urbanization indexes contain seventeen elements, including population urbanization, economic urbanization, spatial urbanization and social urbanization; ecological environment indexes contain ten elements, including environmental governance and environmental pressure.

Table 2. Evaluation indexes of the tourism industry, urbanization and ecological environment.

Systems	Elements	Indexes	Types
Tourism Industry	Scale of tourism reception	Number of international tourists/10,000 people	+
		Number of domestic tourists/10,000 people	+
	Scale of tourism revenue	International tourism revenue/10,000 yuan	+
		Domestic tourism revenue/10,000 yuan	+
		Ratio of total tourism revenue to tertiary industry revenue/%	+
	Size of tourism enterprise	Number of star-rated hotels	+
		Number of travel agencies	+
		Number of scenic spots	+
Urbanization	Population urbanization	Urban population density/(people·km ²)	+
		Proportion of urban population/%	+
		Natural growth rate of urban population/%	+
		Total employed population/10,000 people	+
	Economic urbanization	Per capita GDP/10,000 yuan	+
		Proportion of secondary industry in GDP/%	+
		Proportion of tertiary industry in GDP/%	+
		Urban residents' disposable income/10,000 yuan	+
	Social urbanization	Fixed asset investment/100 million yuan	+
		Student enrolment in ordinary institutions of higher learning	+
		Total water supply/10,000 cubic meters	+
		Total gas supply/10,000 cubic meters	+
		Civil vehicle ownership/unit	+
		Number of health technical personnel/person	+
	Spatial urbanization	Urban construction land area/km ²	+
		Per capita urban housing area/m ²	+
		Per capita urban road area/m ²	+
Ecological Environment	Environmental control	Green coverage in built-up areas/%	+
		Per capita park green area/m ²	+
		Green area/10,000 hectares	+
		Green area in built-up areas/10,000 hectares	+
		Percentage of sewage disposal/%	+
		Harmless disposal rate of household garbage/%	+
		Comprehensive utilization rate of industrial solid waste/%	+
	Environmental pressure	Industrial wastewater discharge/10,000 t	–
		Industrial waste gas emissions/10,000 t	–
		Industrial solid waste emissions/10,000 t	–

4.3. Data Sources

To ensure continuity, systematicness, and availability of data, the index data constructed in this paper were primarily from the China City Statistical Yearbook, China Tourism Statistical Yearbook and Shaanxi Statistical Yearbook from 2001 to 2018. The few missing data were taken from the statistical communique on the national economic and social development of cities in Shaanxi Province, as well as the official website of each municipal tourism bureaus.

5. Results

5.1. Time Evolution Characteristics of Tourism Industry-Urbanization-Ecological Environment Coupling

From 2000 to 2017, the coupling coordination degree between the tourism industry, urbanization and ecological environment in Shaanxi Province had changed from uncoordinated to coordinated, but there were differences in the coupling coordination state in different development stages. To better understand the development characteristics of coupling coordination fluctuations in various cities, the results of coupling coordination degree were divided into four time periods for analysis (Figure 3).

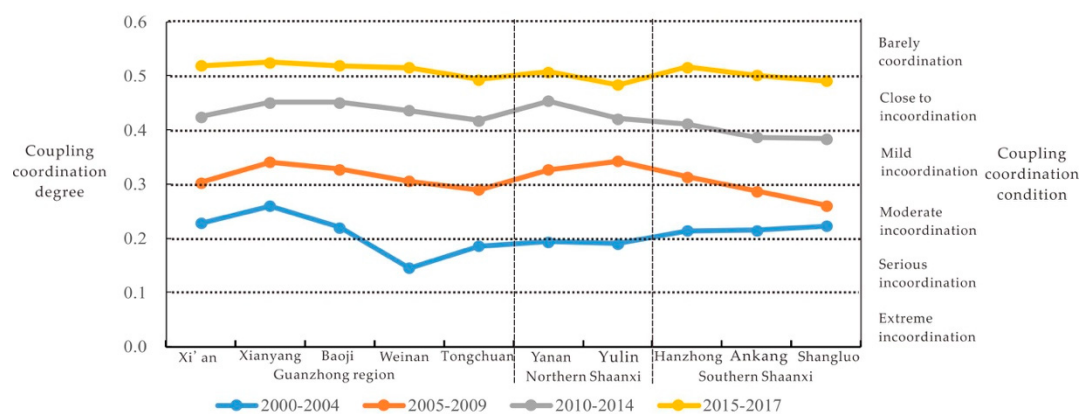


Figure 3. Time evolution characteristics of tourism industry-urbanization-ecological environment coupling in cities of Shaanxi.

From 2000 to 2004, the coupling coordination degree of each city was in the stage of moderate or severe incoordination, with a standard deviation of 0.031. The coupling coordination degrees between the tourism industry, urbanization and ecological environment in Xianyang, Xi'an and Baoji in Guanzhong Region were relatively high, at 0.26, 0.23 and 0.22 respectively. The coupling coordination degree of Yan'an and Yulin in northern Shaanxi remained at about 0.19, close to the state of moderate incoordination. Shangluo, Hanzhong and Ankang in southern Shaanxi all entered the stage of moderate incoordination, with a coupling coordination degree all higher than 0.2.

From 2005 to 2009, the coupling coordination degree of the tourism industry, urbanization and ecological environment in various cities were in the stage of mild and moderate incoordination, with a standard deviation of 0.026. The coupling coordination degrees between the tourism industry, urbanization and ecological environment in Xianyang, Xi'an and Baoji in Guanzhong Region were in the stage of mild incoordination, and the coupling coordination degree of Tongchuan was in the stage of moderate incoordination. Yan'an and Yulin in northern Shaanxi were in the stage of mild incoordination, in which the coupling coordination degree in Yulin increased by 1.8 times to 0.342. Hanzhong in southern Shaanxi had entered the stage of mild incoordination, while Shangluo and Ankang remained in the stage of moderate incoordination.

From 2010 to 2014, the coupling coordination degrees of the tourism industry, urbanization and ecological environment in various cities were in the stage of close to or slight incoordination, with a standard deviation of 0.025. The coupling coordination degrees in Xianyang, Xi'an, Weinan, Tongchuan, and Baoji in Guanzhong Region were at the stage of close to incoordination, with the

coupling coordination degree all higher than 0.4. Yan'an and Yulin in northern Shaanxi were in the stage of close to incoordination, but the coupling coordination degree in Yan'an increased by 38.8%. The coupling coordination degree of Hanzhong in southern Shaanxi was 0.411, on the verge of incoordination, while Shangluo and Ankang remained in the stage of mild incoordination.

From 2015 to 2017, the coupling coordination degrees of the tourism industry, urbanization and ecological environment in various cities were barely coordinated or in the stage of close to incoordination, and basically realized the evolution from incoordination to coordinated development, with the standard deviation dropping to 0.014. The coupling coordination degrees of Xianyang, Xi'an, Weinan, and Baoji in the Guanzhong Region were all higher than 0.5. Yan'an and Yulin in northern Shaanxi were barely coordinated and in the stage of close to incoordination respectively. The coupling coordination degrees in Hanzhong and Ankang in southern Shaanxi were 0.516 and 0.501 respectively, in the barely coordinated stage, while Shangluo was in the stage close to incoordination.

5.2. Spatial Pattern Evolution of Tourism Industry-Urbanization-Ecological Environment Coupling

Figure 4 shows the spatial pattern difference and evolution process of coupling coordination degree in each city from 2000 to 2017. From 2000 to 2004, the coupling of the tourism industry, urbanization and ecological environment in Shaanxi was weak in the north and strong in the middle and south. The cities where coupling coordination degree was in severe incoordination were concentrated in Yulin, Yan'an, Tongchuan, and Weinan, while the cities with moderately uncoordinated coupling degree were concentrated in Xi'an, Xianyang, Baoji and other three cities in southern Shaanxi. In this period, the tourism industry in Yulin, Yan'an, Tongchuan, and Weinan was relatively weak. Among them, the tourism industry in Yulin, Weinan, and Tongchuan only accounted for between about 4% and 10% of their tertiary industry. In terms of the green coverage rate in urban built-up areas, the green coverage rates in Yulin, Tongchuan, Yan'an, and Weinan were only remained at between 5% and 19%, and indexes such as per capita park green area and green area were relatively low. As the tourism industry and ecological environment construction in Yulin, Yan'an, Tongchuan, and Weinan were relatively weak, they had become the weaknesses restricting the coupling of the tourism industry, urbanization and ecological environment. As a result, the coupling coordination degree of the above four cities was in a stage of serious incoordination.

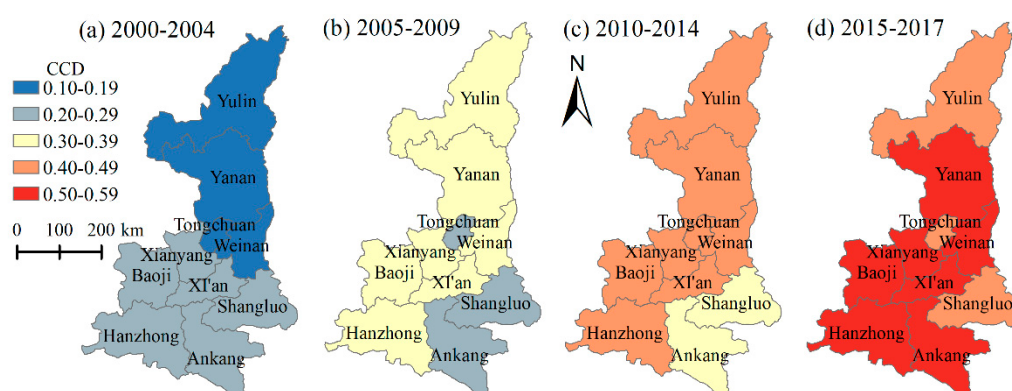


Figure 4. Spatial pattern evolution of the coupling coordination degree of tourism industry-urbanization-ecological environment coupling in cities of Shaanxi in 2000–2017.

From 2005 to 2009, the coupling of the tourism industry, urbanization and ecological environment showed a pattern of strong northern and central regions and weak southern regions. The coupling coordinated development degrees in Tongchuan, Shangluo, and Ankang were moderately uncoordinated, while the coupling coordinated development degree in Xi'an, Xianyang, and Baoji had been improved to the degree of mild incoordination. In this stage, the coupling coordination degrees in Yulin and Yan'an increased by 80% and 69% respectively. The coupling degree of Xi'an, Xianyang, Baoji, and Weinan had reached the degree of mild incoordination, up by more than 33% compared

with the previous stage. The coupling coordination degree in Hanzhong was in the stage of mild incoordination, and those in Ankang and Shangluo were in the stage of moderate incoordination.

From 2010 to 2014, the coupling coordination degrees of the tourism industry, urbanization and ecological environment were at the critical point of transition from incoordination to coordination, and the spatial pattern of coupling coordination degree showed the characteristics of strong northern and central regions and weak southern regions. In this stage, the coupling coordination degrees in Yulin and Yan'an in northern Shaanxi, Xi'an, Xianyang and Baoji in the Guanzhong Region, and Hanzhong in Southern Shaanxi were all close to incoordination, albeit up by more than 23% compared with the previous stage. Although the coupling coordination degrees in Ankang and Shangluo were in the stage of mild incoordination, its coordination degree increased by 31% more than that in the previous stage. On the whole, the coupling coordination degree in each city in northern Shaanxi and the Guanzhong Region increased rapidly, while that in each city in southern Shaanxi increased slowly. There could be various reasons for this. Firstly, With the vigorous growth of tourism consumption demand, tourism's contribution to the national economy was becoming increasingly prominent, local governments were aware of the advantages of the tourism industry in creating jobs for urban population and promoting urban economic development. Therefore, they positioned the tourism industry as a pillar industry of regional development, and the interaction between urban the tourism industry, urbanization and ecological environment was deepening day by day. Secondly, national policies has effect on the development of tourism of Shaanxi cities. Since 2009, from the perspective of top-level design, China has successively promulgated various laws and regulations, including the Opinions of the State Council on Accelerating the Development of Tourism Industry, the Circular on Financial Support for Accelerating the Development of Tourism, and the Outline for National Tourism and Leisure (2013–2020), providing policy support for promoting the coordinated development of the regional tourism industry, urbanization and ecological environment.

From 2015 to 2017, the coupling coordination degree of the tourism industry, urbanization and ecological environment in Shaanxi province presented a spatial pattern of strong central regions and weak southern and northern regions. The coupling coordination degree in Yulin, Tongchuan, and Shangluo were in the stage of mild incoordination, and the coupling coordination degrees in other cities all reached the barely coordinated level, realizing the evolution from incoordination to coordination. In this stage, the coupling coordination degrees in Yulin, Tongchuan and Shangluo increased by more than 14%, and the coupling coordination degrees in Xi'an, Xianyang, Baoji and other cities increased by more than 12%. The reason was that, against the background of policies introduced to support the development of tourism, all cities had taken the development of tourism as an important path of urban transformation and upgrading and the construction of ecological civilization. As a result, the coordination degree of the tourism industry, urbanization and ecological environment in various cities had gradually improved.

5.3. Influencing Factors of Tourism Industry-Urbanization-Ecological Environment Coupling and Their Evolution

Based on the study of the spatiotemporal pattern evolution characteristics of the coupling coordination degree of the tourism industry, urbanization and ecological environment in each city, the leading factors affecting the coupling of the three systems in all cities and the evolution process are analyzed according to the functional contribution of each factor (Table 3).

Table 3. Leading factors and evolution of tourism industry-urbanization-ecological environment coupling in each city.

City	2000–2004	2005–2009	2010–2014	2015–2017
Xi'an	scale of tourism revenue, economic urbanization, environmental control, environmental pressure	size of tourism enterprise, economic urbanization, spatial urbanization, environmental control	size of tourism enterprise, economic urbanization, spatial urbanization, environmental control	scale of tourism reception, size of tourism enterprise, population urbanization, spatial urbanization, environmental control
Xian Yang	scale of tourism reception, economic urbanization, environmental control, environmental pressure	size of tourism enterprise, social urbanization, spatial urbanization, environmental control, environmental pressure	scale of tourism reception, size of tourism enterprise, population urbanization, spatial urbanization, environmental control	scale of tourism revenue, social urbanization, spatial urbanization, environmental control
Baoji	size of tourism enterprise, population urbanization, economic urbanization, environmental control, environmental pressure	size of tourism enterprise, population urbanization, spatial urbanization, environmental control, environmental pressure	scale of tourism reception, size of tourism enterprise, population urbanization, spatial urbanization, environmental control	scale of tourism reception, scale of tourism revenue, population urbanization, social urbanization, spatial urbanization, environmental control
Wei Nan	social urbanization, environmental control, environmental pressure	size of tourism enterprise, population urbanization, spatial urbanization, environmental control, environmental pressure	scale of tourism revenue, economic urbanization, social urbanization, spatial urbanization, environmental control	scale of tourism revenue, scale of tourism reception, size of tourism enterprise, social urbanization, spatial urbanization, environmental control
Thong Chuan	size of tourism enterprise, population urbanization, economic urbanization, environmental control, environmental pressure	scale of tourism reception, size of tourism enterprise, economic urbanization, spatial urbanization, environmental control, environmental pressure	scale of tourism reception, size of tourism enterprise, economic urbanization, spatial urbanization, environmental control	scale of tourism revenue, scale of tourism reception, economic urbanization, social urbanization, environmental control
Yulin	economic urbanization, environmental control, environmental pressure	size of tourism enterprise, spatial urbanization, economic urbanization, environmental control, environmental pressure	scale of tourism reception, size of tourism enterprise, population urbanization, spatial urbanization, environmental control	scale of tourism reception, population urbanization, social urbanization, spatial urbanization, environmental control
Yanan	economic urbanization, spatial urbanization, environmental control, environmental pressure	size of tourism enterprise, economic urbanization, spatial urbanization, environmental control, environmental pressure	scale of tourism reception, scale of tourism revenue, economic urbanization, social urbanization, environmental control	size of tourism enterprise, population urbanization, social urbanization, environmental control
Han Zhong	population urbanization, economic urbanization, environmental pressure	size of tourism enterprise, population urbanization, spatial urbanization, environmental control, environmental pressure	size of tourism enterprise, economic urbanization, population urbanization, environmental control	scale of tourism revenue, scale of tourism reception, size of tourism enterprise, spatial urbanization, environmental control
Ankang	economic urbanization, population urbanization, environmental control, environmental pressure	size of tourism enterprise, population urbanization, economic urbanization, environmental control	scale of tourism revenue, size of tourism enterprise, economic urbanization, population urbanization, environmental control	scale of tourism revenue, scale of tourism reception, size of tourism enterprise, economic urbanization, spatial urbanization, environmental control
Shang Luo	economic urbanization, spatial urbanization, environmental pressure	scale of tourism reception, economic urbanization, spatial urbanization, environmental pressure, environmental control	scale of tourism reception, scale of tourism revenue, economic urbanization, spatial urbanization, environmental control	scale of tourism revenue, scale of tourism reception, size of tourism enterprise, spatial urbanization, environmental control

According to the evolution of the coupling factors of Xi'an's tourism industry, urbanization and ecological environment, the scale of tourism enterprises, the scale of tourism reception, economic urbanization, spatial urbanization, population urbanization and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the leading factors of the coupling between the tourism industry, urbanization, and the ecological environment included tourism revenue, economic urbanization, environmental governance, and environmental pressure, which all had a contribution value greater than 0.2, and the contribution value of environmental pressure reached 0.82. In this period, the ecological environment formed a relatively obvious constraining and stress effect on the coupling development of the three systems. From 2005 to 2009, in addition to factors of economic urbanization and environmental governance, the scale of tourism enterprises and spatial urbanization were prominent factors, with contribution degrees of 0.45 and 0.42 respectively, and the stress effect of environmental pressure declined to 0.39. From 2010 to 2014, the scale of tourism enterprises, economic urbanization, spatial urbanization, and environmental governance were still the leading factors of the coupling of the three systems, and the contribution degrees increased to 0.83, 0.61, 0.69 and 0.73, respectively. From 2015 to 2017, in addition to the scale of tourism enterprises, spatial urbanization and environmental governance, the scale of tourism reception and population urbanization had become the new factors promoting the coupling coordinated development of the three systems, with contributions of 0.86 and 0.81 respectively.

According to the evolution of coupling factors of Xianyang's tourism industry, urbanization and ecological environment, the scale of tourism enterprises, the scale of tourism reception, economic urbanization, social urbanization, spatial urbanization, population urbanization and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the leading factors of the coupling between the tourism industry, urbanization and ecological environment included tourism reception, economic urbanization, environmental governance and environmental pressure, which all had a contribution value greater than 0.23, and the contribution value of environmental pressure reached 0.77. From 2005 to 2009, in addition to factors of environmental pressure and environmental governance, the scale of tourism enterprise, social urbanization and spatial urbanization were prominent factors, with the contribution degrees of 0.41, 0.41, and 0.55, respectively. From 2010 to 2014, in addition to the scale of tourism enterprises, spatial urbanization and environmental governance, the scale of tourism reception and population urbanization played a prominent role in the contribution, becoming the new factors leading the coupling development of the three systems. From 2015 to 2017, the scale of tourism revenue and social urbanization made significant contributions to the coupling between the three systems, with the contribution degree reaching 0.79.

According to the evolution of coupling factors of Baoji's tourism industry, urbanization, and ecological environment, the scale of tourism enterprises, the scale of tourism reception, the scale of tourism revenue, spatial urbanization, population urbanization and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the leading factors of the coupling between the tourism industry, urbanization and ecological environment included the scale of tourism enterprises, population urbanization, economic urbanization, environmental governance and environmental pressure, which all had a functional contribution value greater than 0.19. From 2005 to 2009, in addition to environmental pressure and environmental governance, spatial urbanization as a leading factor of the coupling between the three systems played a prominent role, with the contribution degree reaching 0.58. From 2010 to 2014, the scale of tourism reception, the scale of tourism enterprises, population urbanization, spatial urbanization, and environmental governance became the new leading factors of the coupling development of the three systems, and their contribution values were all higher than 0.50. From 2015 to 2017, in addition to factors of spatial urbanization and environmental governance, the contributions of the scale of tourism revenue and social urbanization to the coupling between the three systems reached 0.91 and 0.80 respectively.

According to the evolution of coupling factors of Weinan's tourism industry, urbanization and ecological environment, the scale of tourism enterprises, the scale of tourism reception, the scale of

tourism revenue, spatial urbanization, social urbanization and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the factors leading the coupling between the tourism industry, urbanization and ecological environment included social urbanization, environmental governance and environmental pressure, which all had a contribution value greater than 0.15. From 2005 to 2009, among the leading factors of the coupling between the three systems, the scale of tourism enterprises, population urbanization, and spatial urbanization made a prominent contribution, with contribution degrees of 0.21, 0.34, and 0.40, respectively. From 2010 to 2014, in addition to factors of spatial urbanization and environmental governance, tourism revenue scale, economic urbanization and social urbanization had become the new leading factors of the coupling development of the three systems, with contribution values of 0.53, 0.57 and 0.63 respectively. From 2015 to 2017, in addition to factors of social urbanization, spatial urbanization and environmental governance, the scale of tourism reception and the scale of tourism enterprises made great contributions to the coupling between the three systems, with contribution degrees increasing to 0.90 and 0.78 respectively.

According to the evolution of coupling factors of Tongchuan's tourism industry, urbanization, and ecological environment, the scale of tourism reception, the scale of tourism revenue, economic urbanization, spatial urbanization, social urbanization and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the factors leading the coupling between the tourism industry, urbanization, and ecological environment included population urbanization, economic urbanization, environmental governance, and environmental pressure, all of which had a contribution value greater than 0.25. From 2005 to 2009, the scale of tourism enterprises, the scale of tourism reception, and urbanization were prominent factors, with the contribution degrees of 0.21, 0.34 and 0.40 respectively. From 2010 to 2014, the contribution of the scale of tourism reception, the scale of tourism enterprises, spatial urbanization and environmental governance to the coupling of the three systems continued to increase, and the contribution values were all greater than 0.58. From 2015 to 2017, in addition to the factors of economic urbanization and environmental governance, the scale of tourism revenue and social urbanization made great contributions to the coupling of the three systems, with contribution degrees of 0.86 and 0.78 respectively.

According to the evolution of coupling factors of Yulin's tourism industry, urbanization, and ecological environment, the scale of tourism reception, the scale of tourism enterprises, population urbanization, spatial urbanization, social urbanization, and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the factors leading the coupling between the tourism industry, urbanization and ecological environment included economic urbanization, environmental governance and environmental pressure, which all had a contribution value greater than 0.24. From 2005 to 2009, the scale of tourism enterprises, spatial urbanization, economic urbanization and environmental governance made a prominent contribution, with contribution values of 0.40, 0.37, 0.46 and 0.39, respectively. From 2010 to 2014, the contribution of the scale of tourism reception, the scale of tourism enterprises, population urbanization, economic urbanization, spatial urbanization and environmental governance to the coupling of the three systems continued to improve, and the contribution values were all greater than 0.43. From 2015 to 2017, in addition to factors of the scale of tourism reception, economic urbanization and environmental governance, the contribution of social urbanization to the coupling of the three systems was 0.87.

According to the evolution of coupling factors of Yan'an's tourism industry, urbanization and ecological environment, the scale of tourism reception, the scale of tourism enterprises, economic urbanization, spatial urbanization, social urbanization, and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the factors leading the coupling between the tourism industry, urbanization and ecological environment included economic urbanization, spatial urbanization, environmental governance and environmental pressure, which all had a contribution value greater than 0.21. From 2005 to 2009, the stress effect of environmental pressure on the coupling between the three systems had weakened, and the scale of tourism enterprise, spatial urbanization, economic urbanization, and environmental governance had been improved, respectively

0.21, 0.41, 0.40 and 0.50. From 2010 to 2014, the contributions of the scale of tourism reception, the scale of tourism revenue, economic urbanization, social urbanization and environmental governance to the coupling of the three systems continued to increase, with contribution values all greater than 0.57. From 2015 to 2017, in addition to the factors of population urbanization, social urbanization, and environmental governance, the contribution degree of the scale of tourism enterprises made great contributions to the coupling of the three systems reached 0.90.

According to the evolution of coupling factors of Hanzhong's tourism industry, urbanization and ecological environment, the scale of tourism enterprises, the scale of tourism reception, the scale of tourism revenue, economic urbanization, population urbanization and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the factors leading the coupling between the tourism industry, urbanization and ecological environment included economic urbanization, population urbanization and environmental pressure, which all had a contribution value greater than 0.26, and the contribution value of environmental pressure reached 0.69. From 2005 to 2009, the scale of tourism enterprises, population urbanization, spatial urbanization and environmental governance made an increasing contribution, with contribution values of 0.46, 0.49, 0.42 and 0.45, respectively. From 2010 to 2014, the contribution of the scale of tourism enterprises, economic urbanization, population urbanization, and environmental governance continued to increase, with contribution values all greater than 0.52. From 2015 to 2017, the scale of tourism revenue, tourism reception and tourism enterprises, spatial urbanization and environmental governance had become the leading factors of the coupling of the three systems, with contribution degree all greater than 0.84.

According to the evolution of coupling factors of Ankang's tourism industry, urbanization and ecological environment, the scale of tourism enterprises, the scale of tourism reception, the scale of tourism revenue, economic urbanization, population urbanization and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the factors leading the coupling between the tourism industry, urbanization, and ecological environment included economic urbanization, population urbanization, environmental governance, and environmental pressure, which all had a contribution value greater than 0.24. From 2005 to 2009, the scale of tourism enterprises, population urbanization, economic urbanization and environmental governance had a prominent contribution, with the contribution values of 0.22, 0.51, 0.30 and 0.46, respectively. From 2010 to 2014, the contribution of the scale of tourism reception and enterprises, economic urbanization and environmental governance to the coupling of the three systems continued to increase, with contribution values all greater than 0.51. From 2015 to 2017, the scale of tourism revenue, tourism reception and tourism enterprises, economic urbanization, spatial urbanization and environmental governance had become the leading factors of the coupling of the three systems, with contribution degrees all greater than 0.73.

According to the evolution of coupling factors of Shangluo's tourism industry, urbanization and ecological environment, the scale of tourism enterprises, the scale of tourism reception, the scale of tourism revenue, economic urbanization, population urbanization, and environmental governance were the key factors leading the coupling of the three systems. From 2000 to 2004, the factors leading the coupling between the tourism industry, urbanization and ecological environment included economic urbanization, spatial urbanization, and environmental pressure, which all had a contribution value greater than 0.22. From 2005 to 2009, the scale of tourism revenue, spatial urbanization, economic urbanization and environmental pressure had a prominent contribution, with the contribution values of 0.18, 0.32, 0.33, 0.31 and 0.61, respectively. From 2010 to 2014, the contributions of the tourism reception and tourism revenue, economic urbanization, and environmental governance continued to increase, with contribution values all greater than 0.50. From 2015 to 2017, the scale of tourism revenue, tourism reception and tourism enterprises, economic urbanization and spatial urbanization had become the leading factors of the coupling of the three factors, with contribution degrees all greater than 0.80.

5.4. Development Modes of Tourism Industry-Urbanization-Ecological Environment Coupling and Their Evolution

Based on the evolution analysis of the leading factors of the coupling of the tourism industry, urbanization, and ecological environment in each city, the leading mode and its evolution process of coupling development in each city can be summarized according to the functional contribution of each leading factor in different development stages (Figure 5).

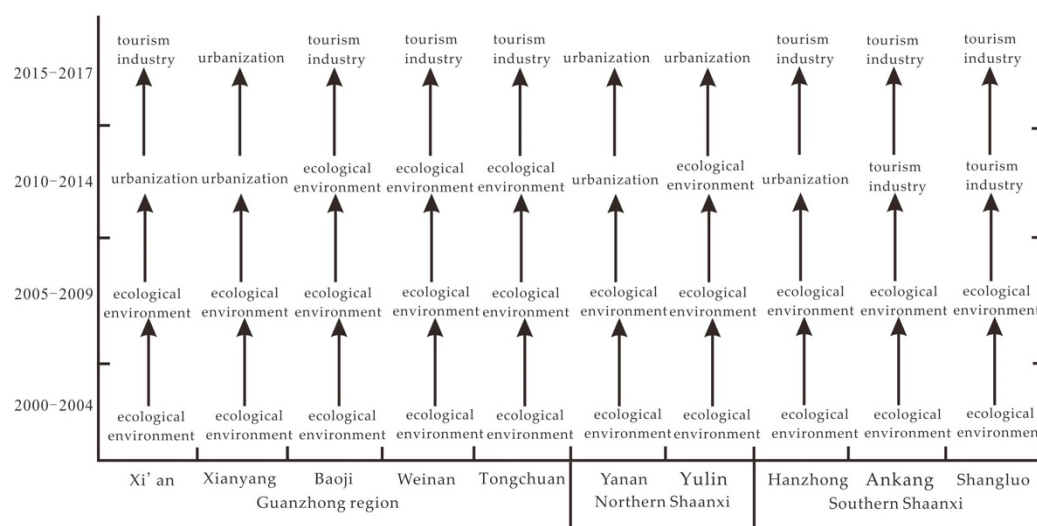


Figure 5. Evolution of the development mode of tourism industry-urbanization-ecological environment coupling in cities of Shaanxi.

From 2000 to 2004, all cities had a coupling development mode dominated by the ecological environment, and the total contribution of urban ecological environment remained at about 0.4, which was greater than that of the tourism industry and urbanization. In this period, the negative factor of environmental pressure in each city had the greatest impact on the coupling of the three systems. The contribution degrees of environmental pressure in Xi'an and Tongchuan were 0.82 and 0.91 respectively; the contribution degrees of environmental pressure in Yulin and Yan'an were 0.98 and 0.95 respectively; and the contribution degree of environmental pressure in Shangluo was 0.96. Overall, the factor of environmental pressure had an obvious constraining and stress effect on the coupling between the tourism industry, urbanization, and the ecological environment in each city. The quality of the coupling development in each city was relatively low, remaining in the development state of serious and moderate incoordination.

From 2005 to 2009, all cities continued to maintain the coupling development mode dominated by the ecological environment, but the stress and the constraining effect of the factor of environmental pressure on the coupling between the tourism industry, urbanization and ecological environment in all cities gradually declined. Meanwhile, the contributions of factors of environmental governance, tourism industry and urbanization were gradually increasing, and the coupling coordination degree in each city had also entered the development state of moderate or mild incoordination. In this period, all cities strengthened their control and treatment of environmental wastewater, waste gas, and solid waste, reducing the negative impact of environmental pressure. The contribution degrees of environmental pressure in Xi'an and Tongchuan decreased to 0.39 and 0.68 respectively; the contribution degrees of environmental pressure in Yulin and Yan'an decreased to 0.85 and 0.79 respectively; and the contribution degree of environmental pressure in Shangluo dropped to 0.61. Meanwhile, the contribution degree of environmental governance in each city increased to between 0.2 and 0.4. Overall, the constraining and stress effect of the factor of environmental pressure on the coupling degree in each city gradually decreased, and the development quality of the coupling between the ecological environment, tourism industry, and urbanization were improved.

From 2010 to 2014, the coupling development mode in various cities began to diverge. The development mode in cities in Guanzhong and northern Shaanxi regions was still dominated by urbanization or the ecological environment, while in cities in southern Shaanxi the development mode was dominated by the tourism industry or urbanization. The tourism industry and urbanization began to show their contribution to the coupling of the three systems, and meanwhile, the contribution of the ecological environment decreased. Cities with ecological environment construction as the development mode were concluded to be Xi'an, Xianyang, Yulin and Hanzhong, where the contribution degrees of urbanization to the coupling of the three systems were 0.61, 0.64, 0.68 and 0.50 respectively. Cities with the tourism industry as the leading mode of development include Ankang and Shangluo, where the contribution degrees of the tourism industry both reached 0.51.

From 2015 to 2017, the coupling development mode in various cities continued to diverge, forming a development mode dominated either by the tourism industry or by urbanization. Cities in the Guanzhong Region had formed a development mode dominated either by urbanization or by the tourism industry, cities in southern Shaanxi have formed a development mode dominated by the tourism industry, and cities in northern Shaanxi have formed a development mode dominated by urbanization. Xianyang, Yulin and Yan'an have formed a development mode dominated by urbanization, where the contribution degrees were 0.81, 0.80 and 0.73 respectively. Cities with the tourism industry as the leading development mode included Xi'an, Baoji, Weinan, Tongchuan, Hanzhong, Ankang and Shangluo in Guanzhong Region, where the contribution degree of the tourism industry was between 0.84 and 0.87.

6. Discussion

The tourism industry is an important path for regional supply-side reform and urbanization development, and ecological environment construction is the premise and foundation of the development of the tourism industry and urbanization. However, there is insufficient attention paid to the identification of leading factors and the development mode of the coordinated development of the tourism industry, urbanization, and the ecological environment. Existing research [27–30] tends to examine the coupling degree of the tourism industry, urbanization, and the ecological environment from a static perspective, and lack the identification, summarization, and evolution analysis of the coupling leading factors and patterns of the three systems. This study measured the evolution characteristics of the coupling coordination degree between the tourism industry, urbanization and ecological environment in cities of Shaanxi province, and identified the leading factors affecting the coupling development of the three systems in different stages and their evolution processes. Moreover, based on the evolution of the leading factors, the paper summarized the coupling development mode in each city and its evolution. The research conclusion further deepens the understanding of the leading factors, patterns and laws of the coupling of the tourism industry, urbanization and ecological environment, and enriches the dimension and depth of the research on tourism coupling. Meanwhile, through the identification and summarization of the coupling leading factors in each city, it sheds light on how to precisely promote the supply-side reform of tourism, the quality development of urbanization, and the construction of ecological civilization in each city.

Studies suggest that the coupling degree of the tourism industry, urbanization and ecology in various provinces and regions along the Silk Road has entered a benign and coordinated development stage [30]. Through the analysis of the coupling coordination degree in cities in Shaanxi Province, it was found that the conclusion of this research further verified the existing research results. The interaction between the tourism industry, urbanization and ecological environment in all cities is deepening, the coordination degree is gradually increasing, and the quality of development keeps improving. Meanwhile, the current mainstream research views hold that urbanization and the tourism industry are important ways to promote the development of regional economic transformation [27]. The results of this study also confirm the existing conclusion that cities in Shaanxi Province have gradually formed a development model dominated by urbanization or the tourism industry. In the context of "Belt

and Road” construction and supply-side reform, the tourism industry and urbanization have become important determinants of the high-quality development of the regional economy.

Evolutionary economic geography holds that endogenous factors determine the development and evolution of the regional economy. Through the correlation between different endogenous factors, the region obtains the impetus for regional development, transformation and upgrading. Moreover, in the process of constant reorganization and differentiation of internal factors in the region, there will be phenomena of path dependence and path breakthrough [33–35]. The tourism industry, urbanization and ecological environment are all important endogenous components of the regional economy. The tourism industry has a strong coupling effect with urbanization and the ecological environment due to its natural cohesion and comprehensiveness. In different stages of development, due to the different contribution degrees of various elements within the tourism industry, urbanization and ecological environment, there are path-dependence and path-breakthrough phenomena in the coupling development of the three systems in cities of Shaanxi Province. Through analysis, it is found that from 2000 to 2009, cities in Shaanxi Province formed a coupling development mode dominated by the ecological environment. The main reason is that the factors of environmental pressure and environmental governance contribute greatly to the coupling development in cities, which determined the coupling development process of the three systems, and then led to the development path dominated by the ecological environment. Since 2010, with the development and contribution of the tourism industry and urbanization, all cities have gradually achieved path breakthrough and formed a coupling development mode dominated by urbanization or the tourism industry.

According to the differences and characteristics of the leading factors and development modes of the coupling of the tourism industry, urbanization, and the ecological environment in cities of Shaanxi Province, the following enlightenment is provided for the sustainable development of the regional economy of each city. Each city can adopt differentiated development measures according to its own characteristic development mode in order to ensure the sustainable development of the regional economy. Yulin, Yan'an and Xianyang, which take urbanization as the leading development mode, can continuously consolidate and enhance the level of urbanization. They take urbanization as the path to drive the development of the regional tourism industry and the protection of the ecological environment. The construction and development of urbanization provide potential and existing tourist source markets for the development of the regional tourism industry, strengthen the construction of transportation, accommodation, communication and other infrastructure in northern Shaanxi, and provide facilities for the extension of the tourism industry chain. Xi'an, Xianyang, and Baoji, which take the tourism industry as the leading development, need to give full play to the comprehensive and relevant advantages of the tourism industry. Through active tourism image publicity, they can show the tourism image of the city and enhance the attractiveness of the city. The tourism industry drives the development of urban catering, accommodation, shopping, transportation, entertainment, sightseeing and other sectors, which can promote urban employment, raise the employment rate of urban tertiary industry, and further the development of population urbanization. The tourism industry can strengthen the integration of the tourism industry with the manufacturing industry, high and new technology, and other industries, improve and extend the urban industrial chain, accelerate the adjustment of the urban industrial structure, and enhance the development vitality of the urban regional economy.

The paper has two deficiencies. For one thing, this study attempted to build a more systematic evaluation index system, but due to the restriction in data availability and continuity, some indexes were missing. This affected the overall understanding of the development law of the coupling between the tourism industry, urbanization and ecological environment in Shaanxi Province. Against the background of high-quality development, the efficiency and growth rate of tourism enterprises have become the key factors affecting the development of the tourism industry. Urban-rural integration and scientific research innovation have become the new factors driving the development of urbanization, while the noise, air pollution, air quality decline and other negative effects brought about by the rapid

development of tourism industry and urbanization will exert pressure on the construction of urban ecological civilization. In the future research, other indexes such as tourism enterprise efficiency, tourism enterprise growth rate, air purity, Integration of urban and rural areas, scientific research innovation, air quality, noise pollution, electronic communication and Internet construction will be considered to obtain a more comprehensive relationship of the three systems. For another, this study identified the leading factors of coupling development of the tourism industry, urbanization and ecological environment in various cities, and summarized their leading patterns. However, the driving force and the internal mechanism that lead to the change of coupling development mode in each city in different stages need to be further studied. In the future, methods such as the co-integration analysis and structural equation model will be adopted to strengthen the analysis of the causal relationship and law between the coupling factors. Moreover, system dynamics will be employed to simulate the dynamic development process of the coupling between the tourism industry, urbanization and ecological environment in various cities.

7. Conclusions

From 2000 to 2017, the coupling coordination degrees of the tourism industry, urbanization and ecological environment in cities in Shaanxi Province had on the whole evolved from seriously uncoordinated to barely coordinated, and the quality of coupling development had been gradually improving. The absolute difference in the coupling coordination degree between cities decreased gradually in the studied period. From the perspective of the spatial pattern, between 2000 and 2017, the spatial pattern of the coupling coordination degree of the tourism industry, urbanization, and the ecological environment in Shaanxi evolved from initially weak northern regions and strong central and southern regions to strong central regions and weak southern and northern regions.

Through the identification and comparative analysis of the leading factors of the coupling in various cities, it is found that between 2000 and 2004, environmental pressure, economic urbanization and tourism reception scale were the key factors of the coupling of the three systems in all cities. However, due to the stress and constraining effects of the negative factor of environmental pressure, the coupling degree of the three systems was relatively low. From 2005 to 2009, the scale of tourism enterprises, economic urbanization, population urbanization, spatial urbanization, and environmental governance became the leading factors affecting the coupling of the three systems, and the constraining effect of environmental pressure declined gradually, which improved the coupling quality of the three systems. Since 2010, the scale of tourism enterprises, reception and tourism revenue, environmental governance, population urbanization, and spatial urbanization factors have become the leading factors of the coupling of the three systems, and the coupling of them has realized the transformation from incoordination to coordination.

The coupling modes of the tourism industry, urbanization and ecological environment in Shaanxi Province have undergone the evolution process of “eco-environment mode-urbanization mode-tourism industry mode”. However, in different development stages, the coupling development mode in each city overlaps to some extent. The coupling mode in cities in Guanzhong Region has evolved from ecological environment mode to dual mode of urbanization and tourism industry, the coupling mode in cities in northern Shaanxi has evolved from ecological environment mode to urbanization mode, and the coupling mode in cities in southern Shaanxi has evolved from ecological environment mode to tourism industry mode. The conclusion of this study can provide a reference for the sustainable development of the tourism industry, urbanization, and the ecological environment in Shaanxi cities.

Author Contributions: Conceptualization, J.L.; methodology, J.L.; validation, J.L.; formal analysis, J.L.; investigation, X.W.; resources, Y.M.; data curation, C.L. and J.T.; writing—original draft preparation, J.L.; writing—review and editing, J.L.; visualization, J.L.; supervision, J.L. and Y.M.; project administration, J.L.; funding acquisition, J.L.

Funding: This research was funded by National Natural Science Foundation of China (grant number 41271158, 41601140), Shaanxi Social Science Foundation (grant number 2018S11), Shaanxi Soft Science Research Project Foundation (grant number 2019KRM105), National Social Science Foundation Incubation Plan of Northwestern University, (grant number XM07190575).

Conflicts of Interest: The authors declare no conflict of interest.

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