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The Spatial and Temporal Evolution and Influencing Factors of the Coupling and Coordinated Development of Basic Public Services, Urbanization, and Tourism in China

Zhongwu Zhang [1,2,3], Jian Gong [1], Huiqiang Ma [4,*] and Jinyuan Zhang [1]

[1] College of Geographic Science, Shanxi Normal University, Taiyuan 030031, China; zhangzw@sxnu.edu.cn (Z.Z.); gongjian9705@163.com (J.G.); zhangjinyuan1@hotmail.com (J.Z.)
[2] Institute of Human Geography, Shanxi Normal University, Taiyuan 030031, China
[3] Institute of Ecology and Environment of Yellow River Basin, Taiyuan 030031, China
[4] School of Culture Tourism and Journalism Arts, Shanxi University of Finance, Taiyuan 030031, China
* Correspondence: mahuiqiang001@126.com

Abstract: Promoting the coordinated development of basic public services, urbanization, and tourism is crucial to the high-quality development of regional economies. Taking China's provinces as the research unit, an evaluation system was constructed, and the spatial and temporal evolution and influencing factors of the coordinated development of the three systems from 2010 to 2020 were measured using the coupling coordination model and geographical detector. The results demonstrate that: (1) From 2010 to 2020, there was a rising trend in basic public services, a declining trend and fluctuating stability in urbanization, and an inverted 'U' change in tourism; (2) the degree of coupling coordination was in a mild coordination state and showed an upward trend, with spatial distribution being high in the east and low in the west; (3) the degree of coupling coordination was spatially concentrated. The core hot-spot area was mainly in the southeast coastal area, and the core cold-spot area was mainly in the northwest inland area, showing a spatial distribution pattern of hot in the east and cold in the west; (4) the main influencing factors in the spatial difference in coupled coordinated development were per capita GDP, road network density, per capita disposable income of residents, urban unit employees, total import and export of goods, per capita fiscal expenditure, and number of tourists; (5) endogenous power (economic pulling power, infrastructure support power, industrial driving force, population agglomeration power) and exogenous power (government regulation power, market promotion power, social security power) together promote coupling coordinated development.

Keywords: basic public services; urbanization; tourism; coupling coordination; influencing factors

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1. Introduction

Coordinated regional development is the only way to achieve high-quality development [1]. The equalization of basic public services can effectively promote regional coordinated development, and is an important driving force for promoting high-quality economic development [2]. Urbanization is a powerful engine for maintaining sustained, healthy, and high-quality economic development [3]; it also promotes the development of related industries and provides many employment opportunities [4]. The growth of green tourism contributes to the high-quality development of a regional economy [5]. Coordinating development of basic public services, urbanization, and tourism is, therefore, essential to achieving high-quality development. Abundant research exists on the relationship between basic public services, urbanization, and single and double systems of tourism. In terms of research content, single-system research focuses on the measurement of levels, such as the comprehensive development level of new urbanization and the level of tourism development [6,7]. In terms of spatial and temporal evolution, the spatial difference in

tourism and urbanization development is obvious [8], and the characteristics of the population urbanization level have also been clearly observed [9]. In terms of influencing factors, public service facilities are closely related to the degree of regional economic development and industrialization [10]. Tourism is influenced by policy orientation, market demand, infrastructure, tourism service quality, etc. [11]. Being located at a high altitude or far from the city center restrict the development of county urbanization [12]. Research on dual-system relationships has revealed the distribution of basic urban public services [13], the coupling relationship between urbanization and public services [14,15], the impact of public services on urban economic development, population agglomeration, and land expansion [16–18], and the development of urbanization leading to the increase in public service costs [19]. Infrastructure is necessary if the development of tourism is to be promoted [20,21]. Research demonstrates clear differences across different regions in terms of proposals, influencing factors, and development modes of tourism urbanization [22–24], the two-way interaction between urbanization and tourism [25–27], and the coupling and coordination degree of urbanization and tourism [28]. The main research methods include using the coupling coordination degree, geographical detector, relative development degree, and the grey Verhulst model to analyze and measure the relative development status, coupling coordination relationship, influencing factors, and future status of basic public services, urbanization, and tourism systems [29–32]. Research has been conducted on a more comprehensive scale; whole countries [33], provincial [34], regional [29,35], city [26], basin [36,37], and urban agglomeration [38,39] levels have all been used as research units to explore the coordinated development of a system within a region.

Reviewing the past literature, academic research on tourism, basic public services, and urbanization generally focuses on the measurement of the development level of a single system, spatial and temporal evolution patterns, and influencing factors. Previous studies on the coupling relationship mainly focused on two systems. this includes research on tourism urbanization, the interaction between basic public services and urbanization, the infrastructure under basic public services to help the development of tourism, and the two-way interaction between urbanization and tourism. However, there is no research on the coupling relationship between these three factors. In addition, previous studies are mainly based on provincial, regional, watershed, urban agglomeration, and other research units, and there is a relative lack of macro-scale research into 31 provinces in China as research units. Based on this, this paper integrates basic public services, urbanization, and tourism into a single research framework, using an econometric model system to explore the spatial and temporal evolution of the coupling coordination degree between basic public services, urbanization, and tourism, and its influencing factors; our study reveals the coupling coordination mechanism among the three. By incorporating the three systems into a research framework, promoting the cross-integration of geography and other disciplines, and exploring the coordinated development of the three systems, we provide a new direction of research into each subsystem, which has certain theoretical expansion significance. A set of long time-series data for each subsystem was obtained and provided data support for the study of regional differences and evolution patterns in the coupling coordination degrees of the three systems. At the same time, combined with the existing research results, the analysis of influencing factors can effectively provide a reference for the coupling and coordinated development of provinces; it can also provide references and guidance for the development of urbanization, the tourism industry, and basic public services in various regions, aiming to provide theoretical support and reference for the high-quality development of China.

2. Research Area Overview and Research Methods

2.1. Overview of the Study Area

China is located between 3°52′ N–53°37′ N and 73°40′ E–135°05′ E in the eastern part of Asia, its western coast on the Pacific being located in the northern hemisphere and the eastern hemisphere; the country has high terrain in the west and low terrain in the

east. There are 34 provincial-level administrative regions in China (including 23 provinces, 5 autonomous regions, 4 municipalities, and 2 special administrative regions). This paper takes 31 provinces in China (excluding Hong Kong, Macao, and Taiwan) as the research unit (Figure 1). As of 2022, China's nine-year compulsory education consolidation rate is 95.50%, and the medical insurance participation rate is stable at more than 95.00%. China's urbanization rate is 65.22%. In 2022, the total number of domestic tourism will be CNY 2.530 billion, and domestic tourism revenue will be CNY 2.04 trillion.

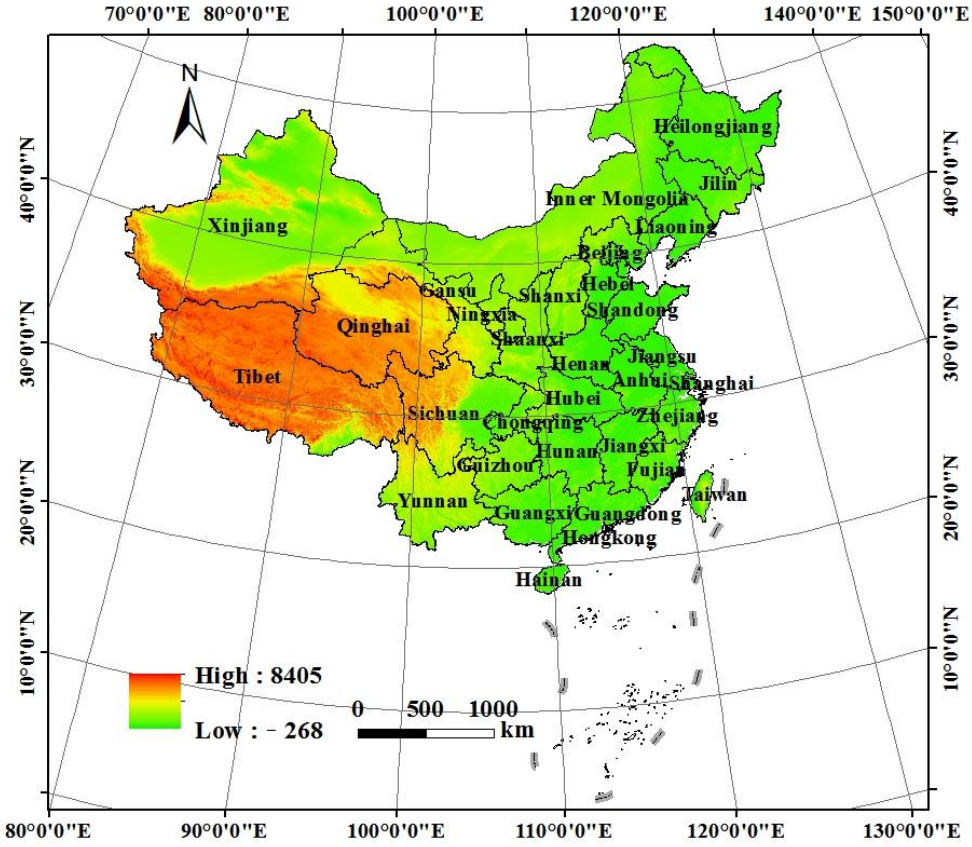

Figure 1. Location of China. Note: The map is based on a standard map, GS (2021) 5447, downloaded from the standard map service website belonging to the National Bureau of Surveying, Mapping and Geoinformation; the base map was not modified.

2.2. Evaluation System Construction

The data were derived from the 'CHINA STATISTICAL YEARBOOK', 'CHINA CITY STATISTICAL YEARBOOK', 'THE YEARBOOK OF CHINA TOURISM STATISTICS', and statistical yearbooks and statistical bulletins for various provinces from 2010 to 2020. The trend extrapolation method was used to fill in a small amount of missing data.

2.3. Data Selection and Evaluation System Construction

We referred to existing research results [6,7,26,32–34,36,37,40,41], and the scientific nature and accessibility of the data to construct the basic public service–urbanization–tourism coupling coordination evaluation system (Table 1). Basic public services are key to ensuring people's livelihood. The selection of indicators considered educational equity, social security improvement, sharing, green, and innovative ideas, thereby covering five aspects: education and cultural services, medical, health care, and social security services; infrastructure services; ecological environment services; and information services. We fully considered the connotation of urbanization. Population urbanization, economic urbanization, land urbanization, and social urbanization are constructed based on population size, economic development, spatial expansion, and social progress. Tourism is a green industry

with significant radiation and driving effects. Relying on its own unique tourism resources, tourism can drive economic growth, expand the market, and promote the development of related industries. Therefore, its index selection includes four aspects: tourism economy, market, resources, and public services. In the index layer, 'ten thousand people' refers to the ratio of the index to the total population at the end of the year. The 'total quality score of A-level scenic spots' is the sum of the product of the number of A-level scenic spots and the coefficient, calculated by consulting experts.

Table 1. Basic public services–urbanization–tourism coupling coordination evaluation system.

Target Layer	Element Layer	Index Layer
Basic public services	education and cultural services	Local fiscal expenditure on education (CNY one hundred million)
		Number of colleges and universities per ten thousand people (colleges/ten thousand people)
		The number of students in regular institutions of higher learning (ten thousand people)
		Number of full-time teachers in primary and secondary schools per ten thousand people (people)
		Local fiscal expenditure on science and technology (CNY one hundred million)
		The total collection of public libraries (ten thousand volumes)
	health and social security services	Number of medical and health institutions per ten thousand people (numbers/ten thousand people)
		Number of beds in medical institutions per ten thousand people (numbers/ten thousand people)
		Number of professional doctors (ten thousand people)
		Number of social welfare homes per ten thousand people (numbers)
		Medical insurance coverage for urban workers (%)
		Basic pension insurance coverage of urban and rural residents (%)
	ecological environmental services	Comprehensive utilization rate of industrial solid waste (%)
		Urban sewage treatment rate (%)
		Harmless treatment rate of municipal solid waste (%)
		Industrial wastewater discharge (million tons)
		Forest coverage (%)
	infrastructure as a service	Public transport vehicles per ten thousand people (numbers)
		Urban water penetration rate (%)
		Urban gas penetration rate (%)
		Number of public toilets (numbers)
	information service	Number of post offices per ten thousand people (numbers)
		Internet penetration (%)
		The number of mobile phone users per ten thousand people (numbers)
Urbanization	population urbanization	Urbanization rate (%)
		Urban population density (person/km^2)
		The proportion of employment in the second and third industries in the total employment (%)
	economic urbanization	GDP per capita (CNY)
		The proportion of the tertiary industry in GDP (%)
		Per capita disposable income of urban residents (CNY)
		Urban fixed assets investment (one hundred million CNY)

Table 1. *Cont.*

Target Layer	Element Layer	Index Layer
	social urbanization	Urban registered unemployment rate (%)
		The number of urban health technicians per ten thousand people (people)
		Engel coefficient of urban households (%)
	space urbanization	Urban built-up area per ten thousand people (km^2/ten thousand people)
		Per capita urban road area (m^2/people)
		Green coverage rate of built-up area (%)
Tourism	tourist economy	Domestic tourism revenue (CNY one hundred million)
		Foreign exchange earnings from tourism (USD ten thousand)
		The proportion of total tourism income to GDP (%)
	tourism market	Number of domestic tourists (one hundred million people)
		The number of inbound tourists (ten thousand people)
		The growth rate of tourists (%)
	tourism resources	A-level scenic spot quality total score (score)
		Total quality score of star hotels (score)
	tourism public services	Number of travel agencies (numbers)
		The number of tourism practitioners (people)

2.4. Research Methods

2.4.1. Comprehensive Evaluation Model

The range method was used to standardize the original data and the entropy method was used to weight each index. The formula is given in the reference [37], and it is not repeated here. The comprehensive evaluation model is as follows:

$$U_i = \sum_{j=1}^{n} w_j \times y_{ij}, i = 1, 2, 3, j = 1, 2, 3, \ldots\ldots n \quad (1)$$

In the formula: "U_1", "U_2", "U_3" are the comprehensive development indexes of basic public services, urbanization, and the tourism system, respectively; w_j is the index weight; "y_{ij}" is the normalized value; and "n" is the number of indexes in each subsystem.

2.4.2. Coupling Coordination Degree Model

Based on coupling theory and previous research results [26], a coupling coordination model of basic public service, urbanization, and tourism was constructed. The formula is as follows:

$$C = 3(U_1 \times U_2 \times U_3)^{\frac{1}{3}}(U_1 + U_2 + U_3)^{-1} \quad (2)$$

$$T = \alpha U_1 + \beta U_2 + \gamma U_3 \quad (3)$$

$$D = \sqrt{C \times T} \quad (4)$$

In the formula, "C" is the coupling degree; the value range of "C" is [0, 1]; T is the comprehensive development index of basic public service, urbanization, and tourism; and "α", "β","γ" are the undetermined coefficients, using the expert scoring method. The final values were obtained by using the expert scoring method, and they were $\alpha = 0.35$, $\beta = 0.35$, $\gamma = 0.3$; "D" is the coupling coordination degree, which indicates the overall coordination effect of basic public service, urbanization, and tourism. Referring to

existing research results [42], the coupling coordination degree for basic public services, urbanization, and tourism was classified into ten categories (Table 2).

Table 2. Classification standard division of coordination degree.

Coordination Degree	Coordination Type	Coordination Degree	Coordination Type
0.00~0.09	Extreme imbalance	0.50~0.59	Slight coordination
0.10~0.19	Serious imbalance	0.60~0.69	Mild coordination
0.20~0.29	Moderate imbalance	0.70~0.79	Moderate coordination
0.30~0.39	Mild imbalance	0.80~0.89	High coordination
0.40~0.49	Slight imbalance	0.90~1.00	Extreme coordination

2.4.3. Spatial Autocorrelation Model

Global spatial autocorrelation is represented by Moran's *I;* local autocorrelation is represented by spatial hot spots [43].

$$I = \sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}(x_i - \overline{x})(x_j - \overline{x}) / S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij} \quad (5)$$

$$G_i^*(d) = \sum_{j=1}^{n} W_{ij}x_j / \sum_{j=1}^{n} x_j \quad (6)$$

In the formula, "n" is the number of samples of the space research unit; "W_{ij}" is the spatial weight matrix; "x_i" and "x_j" are the attribute values of spatial units "i" and "j"; and "$\overline{x}$" and "S^2" are the mean and standard deviation of the spatial unit, respectively.

2.4.4. Geographical Detector

A geographical detector is an effective tool that reveals the driving force of spatial differentiation for various elements [44]. The factor detector formula is as follows.

$$q = 1 - \sum_{h=1}^{L} N_h\sigma_h^2 / N\sigma^2 \quad (7)$$

In the formula, "q" is the explanatory degree of the influencing factors to the coupling coordination degree of basic public services, urbanization, and tourism; "N" and "σ^2" represent the total sample size and variance; and "N_h"and "σ_h" represent the sample size and sample variance of the (h = 1, 2, 3..., L) the layer. The range of "q" is [0, 1]. The greater the q value, the stronger the explanatory power, and vice versa.

The interaction detector explores the explanatory power of the spatial differentiation of the dependent variable when two different driving factors act on the dependent variable at the same time. Table 3 shows the interaction types.

Table 3. Types of interaction.

Judgment Basis	Interaction
$q(X_1 \cap X_2) < \min [q(X_1), q(X_2)]$	Weaken, nonlinear
$\min [q(X_1), q(X_2)] < q(X_1 \cap X_2) < \max [q(X_1), q(X_2)]$	Weaken, uni-
$q(X_1 \cap X_2) > \max [q(X_1), q(X_2)]$	Enhance, bi-
$q(X_1 \cap X_2) = q(X_1) + q(X_2)$	Independent
$q(X_1 \cap X_2) > q(X_1) + q(X_2)$	Enhance, nonlinear

3. Analysis of the Results

3.1. Research on the Development of the Coupling Coordination Degree of Basic Public Services, Urbanization, and Tourism

3.1.1. Time-Series Characteristics of the Comprehensive Development Index of Each Subsystem

The average results for China's basic public services, urbanization, and tourism from 2010 to 2020 were calculated (Figure 2) based on Formula (1).

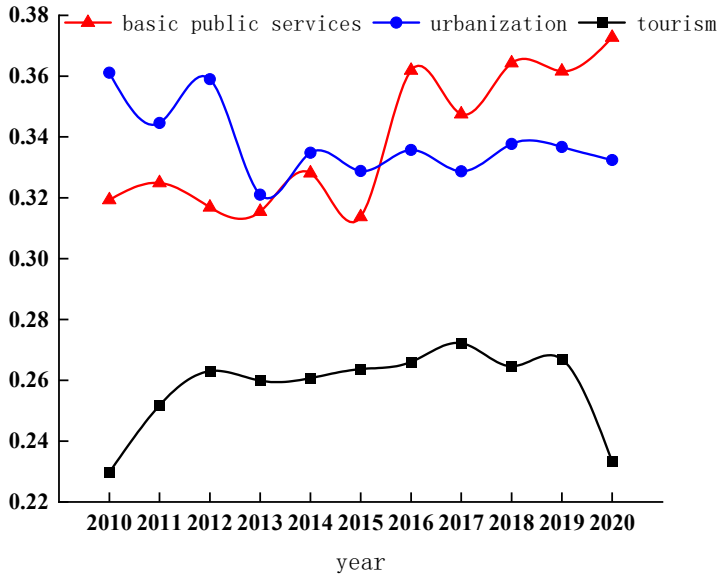

Figure 2. The average value of basic public services, urbanization, and tourism in China from 2010 to 2020.

From 2010 to 2020, the comprehensive development index of basic public services increased from 0.3193 to 0.3727, with an average annual growth rate of 0.5%, showing evident volatility. Before 2015, there was a slight decline in volatility, and after 2015, there was a stage of rising volatility. From 2010 to 2015, the index showed an 'M'-type change trend. The development index increased in 2010, 2012, and 2014, and decreased in 2011, 2013, and 2015. From 2016 to 2020, it showed a 'W' trend and the development index increased. The development index of basic public services was volatile, but it demonstrated a clear upward trend. Basic public services were dominated by the government. China's economy continued to develop well, and the supply of basic public services increased, resulting in an upward trend in the level of basic public services.

From 2010 to 2020, the urbanization development index decreased from 0.3611 to 0.3324, with an average annual decline of 0.3%, in two apparent stages. From 2010 to 2013, the stage of shock declined; from 2013 to 2020, the fluctuation was stable. In 2013, the evaluation index dropped significantly; this may have been related to the government's proposal to integrate the concept and principles of ecological civilization into the process of urbanization, take a low-carbon and intensive new urbanization road, and shift the focus from the speed of urbanization development to the high-quality development of urbanization.

From 2010 to 2020, the tourism development index fluctuated between 0.2297 and 0.2722, showing an inverted 'U' trend of rising first and then falling. Taking 2019 as the dividing line, the tourism development index increased steadily and rapidly from 2010 to 2019, followed by a downward trend in 2020. The trough value in 2020 is related to the outbreak of the new coronavirus in 2019. The epidemic impacted the tourism industry, which was hit hard.

3.1.2. Temporal Evolution Characteristics of Coupling Coordination Degree

The coupling coordination degrees of basic public services, urbanization, and tourism in 31 provinces of China from 2010 to 2020 were calculated (Table 4) based on Formulas (2)–(4).

Table 4. Coupling coordination degree of basic public services, urbanization, and tourism.

Province	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Beijing	0.7601	0.7709	0.7536	0.7555	0.7585	0.7431	0.7504	0.7226	0.7401	0.7162	0.6840
Tianjin	0.5483	0.5576	0.5501	0.5550	0.5594	0.5531	0.5853	0.5490	0.5052	0.5072	0.5050
Hebei	0.5264	0.5334	0.5339	0.5136	0.5198	0.5155	0.5479	0.5427	0.5580	0.5587	0.5273
Shanxi	0.4915	0.4984	0.5200	0.5159	0.5122	0.5108	0.5405	0.5071	0.5159	0.5152	0.4765
Inner Mongolia	0.4766	0.4819	0.4914	0.4926	0.5012	0.4948	0.5275	0.5179	0.5144	0.5376	0.4831
Liaoning	0.6219	0.6274	0.6223	0.6226	0.6238	0.5762	0.5834	0.5670	0.5596	0.5539	0.5201
Jilin	0.4552	0.4608	0.4715	0.4761	0.4707	0.4751	0.5030	0.4707	0.4721	0.4711	0.4773
Heilongjiang	0.5146	0.4986	0.5189	0.4885	0.4856	0.4922	0.5006	0.4853	0.4759	0.4781	0.4696
Shanghai	0.7516	0.7232	0.7043	0.6888	0.6920	0.6759	0.7042	0.6756	0.6793	0.6528	0.7176
Jiangsu	0.7140	0.7343	0.7314	0.7016	0.7213	0.7033	0.7140	0.7107	0.7115	0.7068	0.7155
Zhejiang	0.7041	0.7151	0.7139	0.7055	0.7177	0.7134	0.7096	0.7153	0.7038	0.7003	0.6896
Anhui	0.4970	0.5252	0.5348	0.5097	0.5226	0.5202	0.5487	0.5521	0.5608	0.5711	0.5577
Fujian	0.5681	0.5751	0.5904	0.5767	0.5839	0.5799	0.5956	0.5984	0.5895	0.5958	0.6369
Jiangxi	0.4736	0.4989	0.5110	0.4874	0.5076	0.5080	0.5375	0.5397	0.5699	0.5481	0.5509
Shandong	0.6544	0.6732	0.6643	0.6527	0.6600	0.6543	0.6655	0.6638	0.6693	0.6599	0.6380
Henan	0.5357	0.5344	0.5463	0.5225	0.5385	0.5337	0.5615	0.5603	0.5795	0.5812	0.6105
Hubei	0.5400	0.5413	0.5501	0.5406	0.5601	0.5571	0.5822	0.5739	0.5768	0.5773	0.5587
Hunan	0.5156	0.5127	0.5152	0.5073	0.5325	0.5284	0.5536	0.5572	0.5650	0.5801	0.5928
Guangdong	0.7684	0.7709	0.7756	0.7585	0.7635	0.7686	0.7832	0.7788	0.7911	0.7815	0.7268
Guangxi	0.4536	0.4636	0.4735	0.4551	0.4651	0.4690	0.4964	0.5162	0.5324	0.5447	0.5367
Hainan	0.4150	0.4364	0.4280	0.4128	0.4148	0.4110	0.4277	0.4105	0.4153	0.4088	0.4386
Chongqing	0.5011	0.5063	0.5222	0.4824	0.5037	0.4975	0.5159	0.5169	0.5243	0.5207	0.4827
Sichuan	0.5099	0.5173	0.5372	0.5176	0.5324	0.5227	0.5490	0.5538	0.5830	0.5868	0.5816
Guizhou	0.4195	0.4136	0.4356	0.4269	0.4273	0.4323	0.4783	0.4910	0.5123	0.5178	0.4977
Yunnan	0.4698	0.4715	0.4867	0.4686	0.4845	0.4769	0.5081	0.5252	0.5345	0.5519	0.5334
Tibet	0.4014	0.3818	0.4171	0.3986	0.3834	0.4209	0.3805	0.3551	0.3722	0.3737	0.3733
Shaanxi	0.5190	0.5308	0.5432	0.5278	0.5409	0.5313	0.5428	0.5443	0.5569	0.5591	0.5166
Gansu	0.3914	0.4018	0.4391	0.4164	0.4113	0.4220	0.4389	0.4464	0.4447	0.4422	0.4333
Qinghai	0.3198	0.3383	0.3243	0.3428	0.3514	0.3567	0.3786	0.3854	0.3779	0.4136	0.3886
Ningxia	0.2838	0.3131	0.3554	0.3802	0.3057	0.3207	0.3477	0.4152	0.3093	0.3739	0.3807
Xinjiang	0.5111	0.4935	0.4937	0.4741	0.4789	0.4764	0.4921	0.4984	0.4972	0.5154	0.4728
mean value	0.5262	0.5323	0.5405	0.5282	0.5332	0.5304	0.5500	0.5467	0.5483	0.5517	0.5411

The average value of the coupling coordination degree of the three systems was always in a state of mild coordination. From 2010 to 2020, the average value of the coupling coordination degree increased from 0.5262 to 0.5411, which indicates that the three systems promoted each other at a high level and developed steadily and in coordination.

From 2010 to 2020, the coupling coordination degree level of 18 provinces changed, and stability was low. Affected by the development and progress of basic public services, urbanization, and tourism subsystems to varying degrees, the coupling coordination degree of eight provinces, including Fujian, Hunan, and Guangxi, rose to a higher level of grade type, and Ningxia was affected by the vigorous development of tourism. The coupling coordination degree rose by 0.0970.

The coupling coordination degree of eight provinces, including Beijing, Chongqing, and Liaoning, decreased to a lower grade type. Among them, the development of each subsystem in Liaoning was restricted, and the coupling coordination degree decreased by 0.1018.

Inner Mongolia and Jilin rose from the slight coordination level to the excellent level in 2016, but fell into the slight imbalance level range in 2020 due to the decline in urbanization development.

In the 18 provinces where the coupling coordination degree level changed, the changes in each subsystem had an impact on the coupling coordination degree of the three systems, which changed the coupling coordination degree level.

From 2010 to 2020, the coupling coordination degree level of 13 provinces remained unchanged and relatively stable. The coupling coordination degree changed slightly, fluctuating up and down within the original coordination degree interval, but the coordination degree level did not change. For example, Shanghai, Jiangsu, and Guangdong maintained a moderate coordination level; Tianjin, Hebei, Sichuan, Shaanxi, and other provinces maintained a slight coordination level; Hainan and Gansu maintained a slight imbalance level; and Shandong and Qinghai maintained mild coordination and mild imbalance, respectively.

3.1.3. Spatial Evolution of Coupling Coordination Degree

Spatial distribution maps of the coupling coordination degree of basic public services, urbanization, and tourism were drawn according to the classification criteria of coordination degree (Figure 3). The coupling coordination degree level shows a decreasing trend from the southeast coast to the northwest inland. There is a moderate and mild coordination distribution in Beijing, Jiangsu, Shanghai, Guangdong, and other eastern coastal or economically developed provinces; the slight coordination is mainly distributed in the central and southwestern regions; and the slight and mild imbalances are distributed in the western inland provinces such as Gansu, Ningxia, Qinghai, and Tibet.

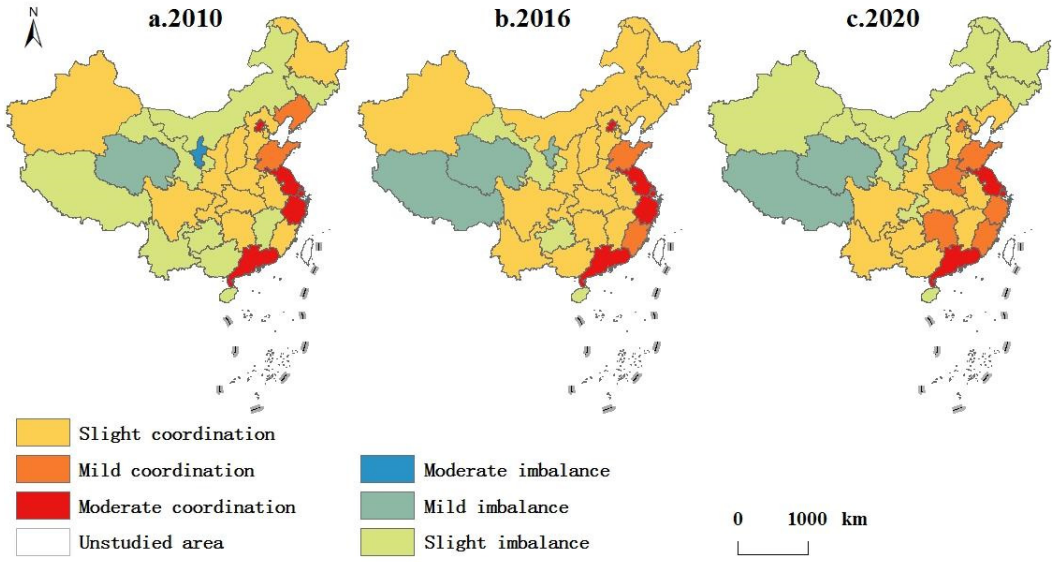

Figure 3. Spatial distribution of coupling coordination degree of basic public services–urbanization–tourism. Note: The map is based on the standard map GS (2021) 5447, downloaded from the standard map service website belonging to the National Bureau of Surveying, Mapping and Geoinformation; the base map was not modified.

The provinces with moderate coordination are distributed in the economically developed areas along the eastern coast and their number is decreasing. From 2010 to 2020, the comprehensive scores for basic public services, urbanization, and tourism in Beijing decreased from 0.5874, 0.7993, and 0.3906 to 0.5241, 0.7579, and 0.2383; the comprehensive scores of basic public services and urbanization in Zhejiang also decreased from 0.4680 and 0.5458 to 0.5577 and 0.5001. The development level of the subsystem decreased, directly affecting the development of the coupling coordination degree. The coordination degree levels of Beijing and Zhejiang, which demonstrated moderate coordination in 2010, declined.

The provinces with mild coordination are distributed in the eastern coastal areas, with a tendency to expand to the central inland area, and their number is increasing. On the one hand, from 2010 to 2020, the benign development of each subsystem in Fujian, Henan, and

other places improved and resulted in reciprocal promotion, thereby increasing the coupling coordination degree of the three systems. On the other hand, the coordination degree levels of Beijing and Zhejiang declined, increasing the number of mild coordination levels.

The provinces demonstrating slight coordination are distributed in the central inland provinces, gradually evolving to the western and southern provinces; their number is declining. The process of quantitative change is an inverted 'V'-shaped trend—rising first and then falling. In 2010, 2016, and 2020, the number of slight coordination levels was 13, 18, and 11, respectively. In 2016, Jilin, Inner Mongolia, and other provinces with slight coordination decreased to the level of a slight imbalance by 2020, resulting in an inverted 'V' trend in slight coordination.

The provinces demonstrating a slight imbalance expanded to the west and northeast, and their number decreased. The evolution process was a 'V'-shaped trend that decreased first and then increased. The coupling coordination degree of Shanxi, Heilongjiang, Chongqing, and Xinjiang decreased from slight coordination to slight imbalance. In 2016, the coupling coordination degree of the above four provinces already demonstrated slight coordination, but in 2020, the tourism industry was affected by the COVID-19 pandemic, and the decline in tourism development led to a decline in the coupling coordination degree of the three systems.

The number of provinces demonstrating mild and moderate imbalances is evenly distributed; for example, Ningxia, Qinghai, and Sichuan provinces, which rose and fell, respectively. Tibet's coupling coordination degree decreased to a mild imbalance, while that of Ningxia increased to a mild imbalance. Briefly, the coupling coordination degree of the three systems demonstrated a slight upward trend, with slight differences among regions. The coupling coordination degree of the eastern coastal and central regions increased slightly, while that of the northeast and western regions decreased slightly.

The coupling coordination degree level shows a decreasing trend from the southeast coast to the northwest inland area. The distribution pattern is high in the east and low in the west. The eastern region has obvious location advantages, convenient transportation, a border opening to the outside world, early urbanization, a high level of development, and an excellent and modern service system of tourism. The western region is far inland, its facilities are weak, its level of urbanization is low, and the extensive development of its tourism restricts economic development. The eastern region has a significant advantage over the western region: the development level of each subsystem is higher and the coupling coordination degree level is better, forming a distribution of east high and west low.

3.2. Spatial Agglomeration of Basic Public Services–Urbanization–Tourism Coupling Coordination Degree

3.2.1. Overall Coordination Level and Spatial Agglomeration Characteristics

The global Moran's *I* index for three years was calculated using Formula (5) and based on the basic public service–urbanization–tourism coupling coordination indexes for 2010, 2016, and 2020 to obtain the global spatial autocorrelation of the coupling coordination degree (Table 5). Table 5 shows that the global Moran's *I* values for the three years are positive, and the Z scores all exceed the critical value of the 0.01 confidence level of 1.96. It can be seen that the coupling coordination degrees of the three systems have strong spatial autocorrelation. They are not independent in space but tend to gather, and there is mutual dependence between the systems.

3.2.2. Spatial Differentiation of Local Autocorrelation

To further illustrate the spatial aggregation distribution of the development level of the coupling coordination degree of basic public services, urbanization, and tourism, based on Formula (6), the number and proportion of the distribution of the types of cold and hot spots in the coupling coordination degree are shown in Table 6. In addition, the evolution

of the spatial pattern of cold and hot spots in the coupling coordination degree of basic public services, urbanization, and tourism are shown in Figure 4.

Table 5. The global spatial autocorrelation of the coupling coordination degree of basic public services, urbanization, and tourism.

Year	M (I)	Z (I)	P (I)
2010	0.196	2.983	0.003
2016	0.222	3.328	0.001
2020	0.247	3.619	0.000

Table 6. The number and proportion of cold- and hot-spot-type distribution of coupling coordination degree.

Regional Type	2010		2016		2020	
	Amount	Proportion	Amount	Proportion	Amount	Proportion
high significant hot spots	2	6.44	2	6.44	3	9.66
medium significant hot spots	2	6.44	3	9.66	3	9.66
low significant hot spots	1	3.22	2	6.44	2	6.44
not significant	20	64.58	18	58.14	16	51.7
low significant cold spots	2	6.44	1	3.22	2	6.44
medium significant cold spots	4	12.88	4	12.88	4	12.88
high significant cold spots	0	0	1	3.22	1	3.22
unstudied area	3	-	3	-	3	-

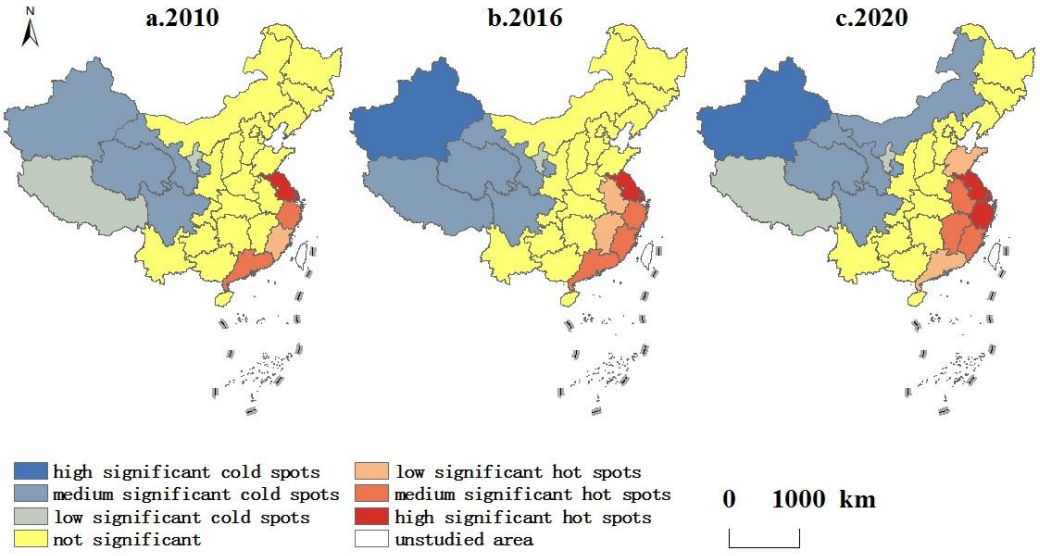

Figure 4. The evolution of the cold and hot spatial patterns of the coupling coordination degree of basic public services, urbanization, and tourism. Note: The map is based on the standard map GS (2021) 5447 downloaded from the standard map service website of the National Bureau of Surveying, Mapping and Geoinformation. The base map was not modified.

The analysis of cold and hot spots explains the significant locations of spatial accumulation and the degree of regional correlation well. In terms of the change in the number of cold- and hot spot distributions, the proportion of hot-spot high-, medium-, and low-significance areas, and cold-spot high- and low-significance areas, increased from 2010 to 2020. The significant areas in the cold spot remained unchanged, and the proportion of the non-significant areas decreased. It can be seen that the hot spots constantly radiate outward, and the cold spots also spread constantly. The agglomeration effect of the coupling coordination degree of the three systems is obvious and spatial aggregation expanded.

Regarding spatial distribution patterns, there are significant differences in the coupling coordination degree of China's three systems in space. The hot spots are mainly distributed in the southeast coastal areas such as Shanghai, Jiangsu, Zhejiang, Fujian, and Guangdong. The cold spots are mainly distributed in the western inland areas such as Xinjiang, Tibet, Gansu, Ningxia, and Qinghai. The southeast coast is significantly better than the western inland areas.

Regarding spatial distribution evolution, the hot spots in 2010–2020 were centered on the eastern coastal areas such as Jiangsu and Shanghai, and continued to radiate and diffuse northward and westward. The hot spots expanded significantly and their calorific value increased. For example, Zhejiang rose to become a high-significance hot spot, while Anhui, Jiangxi, and Fujian rose to become medium-significance hot spots; meanwhile, Shandong rose to become a low-significance hot spot. From 2010 to 2020, the distribution of cold-spot areas was relatively stable, and the cold values were also relatively stable. Western inland provinces such as Xinjiang, Tibet, Qinghai, and Gansu were at the distribution core, and slowly spread eastward. Xinjiang rose to become a high-significance cold spot, and Inner Mongolia rose to become a low-significance cold spot. This shows that the coordinated development of the eastern region was more rapid, and the overall development of the western region was positive. Nevertheless, the level was not as good as that of the eastern region.

To some extent, the theory of unbalanced regional economic growth can explain the spatial distribution evolution of the coupling coordination degree of the three systems. The favorable factors converge to the eastern coastal areas, while the unfavorable factors continue to accumulate in the western region. The economic factors in the eastern region are better, attracting resources and technology. Polarization effects and policy inclination restrain the development of the western region and aggravate the imbalances in regional economic development between the eastern and western regions. The eastern region is economically developed, the development level of each subsystem is high, and the coupling coordination degree is more effective in terms of the radiation diffusion effect. This drives the development of the surrounding areas to form a hot-spot high-value agglomeration area, while the western region forms a cold-spot agglomeration area.

The coupling coordination degree of the three systems has an obvious spatial agglomeration effect, forming a hot-spot area with the southeast coast as the core and a cold-spot area with the northwest inland as the core. The cold and hot spots gradually spread outward to form a spatial agglomeration distribution pattern of hot in the east and cold in the west.

3.3. The Influencing Factors of the Coordinated Development of Basic Public Services, Urbanization, and Tourism

3.3.1. Analysis of Influencing Factors

Regarding the relevant results and comprehensive consideration of expert opinions, the coupling coordination degree was used as the explanatory variable, and economic development, industrial structure, infrastructure, government behavior, population factors, marketization level, and social security degree were selected as explanatory variables. The q values were obtained using Formula (7) (Table 7).

Table 7. Detection results for coupling coordination degree factors of basic public service, urbanization, and tourism.

Year	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
2010	0.5186	0.4158	0.2176	0.4779	0.4127	0.6650	0.4619	0.8655	0.7599	0.9057	0.4831
2016	0.3954	0.6144	0.2516	0.1760	0.6115	0.6048	0.6407	0.9330	0.7909	0.8686	0.5838
2020	0.6435	0.5788	0.2401	0.4550	0.6411	0.5623	0.7075	0.9223	0.7660	0.7860	0.3252

There are significant differences in the influence of factors for 2010, 2016, and 2020. The q values of GDP per capita (X_1), per capita disposable income of residents (X_2), road network density (X_5), per capita fiscal expenditure (X_7), urban unit employees (X_8), number of tourists (X_9), total import and export of goods (X_{10}), and so on, which are located in the upstream, represent the main influencing factors for the development of coupling coordination degree. The q values for the proportion of the tertiary industry in GDP (X_4) and Internet penetration (X_6) are in the middle reaches, which represent the secondary influencing factors for the development of coupling coordination degree. The q values for the proportion of total tourism income to GDP (X_3) and medical insurance coverage for urban workers (X_{11}) are in the lower reaches, which represent the general influencing factors of the development of coupling coordination degree.

The q values of road network density (X_5) and per capita fiscal expenditure (X_7) increased, and the impact on the coupling coordination degree was enhanced. The q values of Internet penetration (X_6) and total import and export of goods (X_{10}) continued to decline, reducing the impact. The q values of per capita disposable income of residents (X_2), the proportion of total tourism income to GDP (X_3), urban unit employees (X_8), number of tourists (X_9), and medical insurance coverage for urban workers (X_{11}) changed to an inverted 'V' type. Finally, the q values of GDP per capita (X_1) and the proportion of the tertiary industry in GDP (X_4) changed to a 'V'-type trend.

3.3.2. Significant Interaction

In the interactive detection (Figure 5), there are only two relationships—between Enhance, bi-, and Enhance, nonlinear. The relationship between weakened and independent is not shown. This demonstrates that the development of the coupling coordination degree of basic public service, urbanization, and tourism was the result of the comprehensive effect of various factors such as economic pulling power, industrial driving force, traffic accessibility, information-based degree, government regulation power, population agglomeration power, market promotion power, social security power, and so on. The interaction of each factor strengthens the ability to explain the coupling coordination degree. For example, regarding the proportion of total tourism income to GDP (X_3), the explanatory power is relatively weak in the factor detection, but the explanatory power is significantly increased after interaction with other factors. The q value is above 0.7.

Economic growth is the driving force promoting the coupling and coordinated development of the three systems. Infrastructure is a material guarantee and supporting force underpinning the promotion of the coupling and coordinated development of the three systems. The optimization and upgrading of industrial structure comprise the driving force that promotes the coupling and coordinated development of the three systems. As a social subject, the population factor is the agglomeration force promoting the coupling and coordinated development of the three systems. Based on the results of factor and interaction detection, the q values of most indicators under the above four independent variable types are in the forefront, or increasing. Moreover, these indicators have an important impact on the coupling coordination degree and play an endogenous dynamic role. Government behavior, marketization level, and social security level are indispensable to the coupling and coordinated development of basic public services, urbanization, and tourism. Change and development in the former have an exogenous dynamic impact on the change in the coupling and coordination degree of the three systems. The government plays the role of macro-control, market supervision, and other functions in the coordinated development of the three systems. Market opening plays a driving role in the coupling and coordinated development of the three systems. Social security can improve people's well-being and play a role in the coordinated development of the three systems. Based on the results of factor and interaction detection, the q values of per capita fiscal expenditure, and total import and total import and export of goods, are in the forefront; the q value of medical insurance coverage for urban workers in 2016 was 0.5838. These indicators also have an important impact on the coupling coordination degree and play an exogenous dynamic role.

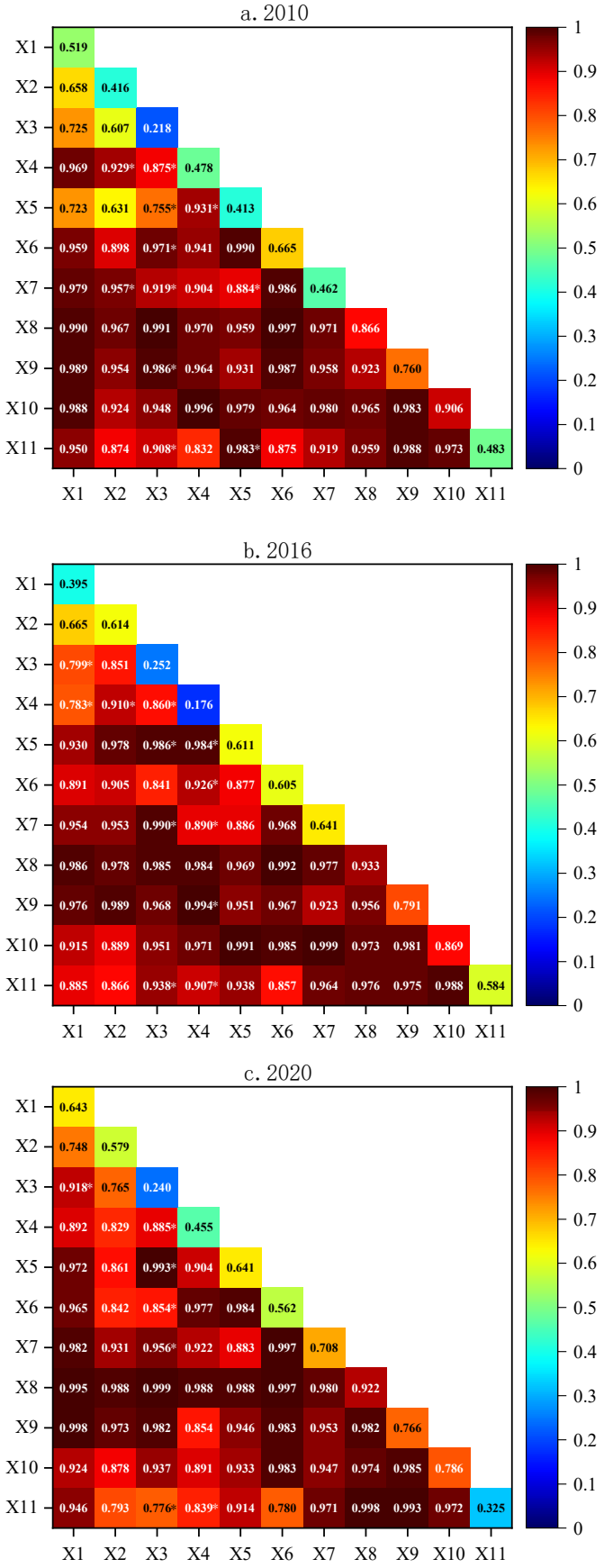

Figure 5. Interactive detection results for influencing factors of coupling coordination degree in 2010, 2016, and 2020. (Note: * is Enhance, nonlinear; the remainder is Enhance, bi-).

Different forces generated by each influencing factor are classified into endogenous and exogenous power. Endogenous power comes from the system as the foundation and original force. Exogenous power is related to the system's external environment promoting the role. Both endogenous and exogenous power impact the coupling and coordinated development of the three systems. In short, the development of China's basic public service, urbanization, and tourism coupling coordination degree is driven by endogenous power (economic pulling power, infrastructure support power, industrial driving force, population agglomeration power) and exogenous power (government regulation power, market promotion power, social security power).

4. Discussion

Different to previous studies, this paper takes 31 provinces in China as the research unit, and innovatively integrates basic public services, urbanization, and tourism into a framework for research; this enriches the macro-scale research in this field. This method provides a reference for the coupling and coordination research of other systems and enriches the cross-integration of geography and other disciplines. At the same time, based on the analysis of influencing factors, it provides a reference for the development of urbanization, the tourism industry, and basic public services in various regions, and aims to provide a reference the high-quality development of China.

In terms of spatial distribution of coupling coordination degree, there is a coupling relationship and obvious regional differentiation, the spatial distribution being high in the east and low in the west; this is consistent with the relevant research results [31]. The development level of urbanization tourism in different regions is different, and the spatial differentiation of coupling coordination degree is obvious. The eastern region is economically developed, the level of urbanization and tourism development is high, and the coupling coordination degree is higher than that of the western region, forming a distribution pattern of high in the east and low in the west.

In terms of spatial agglomeration, the coupling coordination degree forms the agglomeration characteristics of the hot east and cold west, which is consistent with previous research results [15]. The economically developed areas rely on the advantages of location, resources, science, and technology to promote the high-quality development of tourism and urbanization, producing a diffusion effect that plays a radiation-driven role, and forming a calorific value agglomeration around them. The economically underdeveloped areas in the western region are affected by the polarization effect. The development level of each subsystem is limited and forms a cold-value agglomeration.

In terms of the influencing factors of coupling coordination, there are differences between the main influencing factors of coupling coordination and related research [15,19,29]. Previous studies generally focused on two of the three systems: basic public services, urbanization, or tourism, and the influencing factors were, also, only related to two systems. In this paper, all three systems were included in the research framework. Coupling coordination is affected by government behavior such as per capita fiscal expenditure and road network density, as well as urbanization factors such as per capita GDP, and tourism factors such as number of tourists. Including three systems supplements and improves the influencing factors of the coupling coordination compared with a two-system study. The coupling and coordinated development of the three systems was affected by the combined effect of endogenous power and exogenous power, which is consistent with the results of this study [33].

This paper has several limitations. Due to the limitation of data acquisition, some indicators were not included in the index system, resulting in a slight deviation in the measurement results. This paper only reveals the law of development and change from the macro level of large scale; the micro scales of city and county were excluded. In line with the team's future research direction, we will next explore a longer time series, more detailed indicators, and multi-scale directions to provide a more accurate reference for regional sustainable development.

5. Suggestions

First, as the basis and guarantee of basic public services, the government should promote the equalization of basic public services, to narrow the gap in regional service levels. As a green industry, the healthy development of tourism drives the development and progress of related industries. The government should change its development ideas from industrialization-based urbanization to new green urbanization development, encourage cities to develop tourism according to local conditions, drive urban development with tourism, and expand urbanization to feed forward into tourism, expand urban functions, and improve resource utilization efficiency. The three systems are closely related to each other. Promoting the coordinated development of the three systems will help the sustainable development of regional urbanization, tourism, and other industries, and achieve high-quality economic development.

Second, basic public services, urbanization, and tourism in the eastern region enjoy a high level of development, and their coupling coordination degree is highly concentrated. In the future, we will maintain the high-quality development trend of urbanization and tourism, pay attention to the protection of the ecological environment, continue to improve the leisure tourism vacation system, and play an exemplary role. The central and western regions have changed their development mode of urbanization from traditional to low-carbon-intensive, relying on unique natural scenery, customs and culture, ancient monuments, red tourism resources, and so on. This should result in characteristic tourism, stronger construction of tourism infrastructure, and a modern service system, thereby realizing the sustainable development of urbanization and tourism in the central and western regions. In short, each province should address the development shortcomings in the three systems, formulate policies in line with the development of the region, and narrow the differences between regions to achieve coordinated development between regions. Narrowing the development gap between eastern and western China is essential to achieving the sustainable development of all regions in China.

6. Conclusions

We used the coupling coordination degree model, spatial autocorrelation model, and geographic detector to measure the spatial and temporal evolution and influencing factors of the coordinated development of basic public services, urbanization, and tourism from 2010 to 2020. Our results show that:

(1) From 2010 to 2020, there was comprehensive development: basic public services showed a rising trend, urbanization experienced a declining and fluctuating stability, and the tourism industry demonstrated an inverted U-shaped trend of rising first and then falling.

(2) During the same period, for coupling coordinated development, the average value of the coupling coordination degree of the three systems was always in mild coordination and showed a slight upward trend; the stability of the coupling coordination degree for 18 provinces was low, and their levels changed. The coupling coordination degree for 13 provinces was relatively stable and remained unchanged. Spatially, the level of coupling coordination degree decreased from southeast to northwest, and the spatial heterogeneity of coupling coordination degree in each region was obvious. From 2010 to 2020, the coupling coordination degree of the eastern coastal and central regions increased slightly, while that of the northeast and western regions decreased slightly.

(3) The spatial agglomeration of coupling coordination degree was revealed by the coupling coordination degree of the three systems, which demonstrates strong spatial autocorrelation, and with a tendency to gather in space; the agglomeration effect was obvious and interdependence between the systems exists; the coupling coordination degree of the three systems has an obvious spatial agglomeration effect, forming a hot-spot area with the southeast coast as the core, and a cold-spot area with the northwest inland area as the core. Both cold and hot spots gradually radiated outward,

forming a spatial agglomeration distribution pattern of hot in the east and cold in the west.

(4) In terms of influencing factors of coupling coordination degree, the coupling and coordinated development of China's three systems is affected by many factors, and the influence of each factor is different in different years. The results of interaction detection showed different levels of Enhance, bi- and Enhance, nonlinear. The coupling and coordinated development of the three systems results from the combined effect of endogenous power (economic pulling power, infrastructure support power, industrial driving force, population agglomeration power) and exogenous power (government regulation power, market promotion power, social security power).

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