Analysis of Spatiotemporal Evolution and Impediments in the Coupling Coordination between High-Quality Tourism Development and Urban Resilience in Chongqing

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Abstract: In the context of a complex and volatile global environment and the post-pandemic era, tourism, as a vital engine for urban economic development, its high-quality development and the concurrent building of urban resilience against risk shocks have become pivotal for sustainable urban development. This study aims to systematically investigate the coupling and coordination relationship between high-quality tourism development and urban resilience in Chongqing, and to identify key factors constraining their synergistic advancement. Quantitative analysis was conducted using the entropy method, a coupling coordination index model, and an obstacle degree model. Key findings reveal that between 2019 and 2023, the coupling coordination degree between high-quality tourism development and urban resilience in Chongqing's "One Zone and Two Clusters" exhibited a fluctuating upward trend. However, significant regional disparities exist, and each area faces distinct primary obstacles. Based on these findings, this study proposes targeted policy recommendations, including optimizing top-level design, strengthening resilience building, promoting tourism transformation and upgrading, and implementing differentiated development strategies. These recommendations aim to provide a scientific basis and decision-making references for the sustainable development of Chongqing's tourism industry and the enhancement of urban resilience.

Keywords: Urban resilience; High-quality tourism development; Coupling coordination; Impediments; Chongqing Municipality

1. Introduction

1.1. Research context

Currently, China is vigorously promoting high-quality development and resilient city construction. As a vital

engine of the national economy, the sustainability and risk resilience of tourism are intrinsically linked to urban resilience building. Despite its rapid growth, Chongqing's tourism sector has exhibited systemic vulnerabilities when subjected to external shocks, underscoring the critical role of resilience building in safeguarding its high-quality development. Given their mutually reinforcing relationship, this study focuses on the unique period from 2019 to 2023. It deeply analyzes the coupling coordination, spatiotemporal evolution, regional disparities, and impediments between high-quality tourism development and urban resilience within Chongqing's "One Zone and Two Clusters" framework, aiming to provide scientific evidence.

1.2. Research significance
1.2.1. Theoretical significance
By thoroughly examining the coupling coordination between high-quality tourism development and urban resilience in Chongqing's "One Zone and Two Clusters" strategy, this study aims to enrich the theoretical framework for their synergistic advancement. By constructing a more comprehensive and timely indicator system and employing quantitative analysis using coupling coordination and obstacle models, this study will provide new empirical evidence for revealing the interaction mechanisms and constraints between tourism and urban resilience. This will further refine theories concerning sustainable urban development and tourism resource integration.

1.2.2. Practical significance
The findings will provide scientific decision-making support for Chongqing's tourism development planning, optimization of resource allocation, enhancement of infrastructure, ecological conservation, and strengthening of risk prevention capabilities within the "One Zone and Two Clusters" framework. By identifying key impediments across regions, this research enables Chongqing to formulate tailored development strategies, thereby advancing the synergistic enhancement of high-quality tourism development and urban resilience. Furthermore, this research offers valuable experience and policy references for other Chinese cities with similar regional characteristics in advancing sustainable tourism development and urban resilience construction.

1.3. Literature review
1.3.1. Urban resilience research
The concept of "resilience" originated in engineering before expanding into ecological, social, and economic domains, subsequently being introduced into urban studies [1]. Overseas research has evolved from engineering resilience to socio-ecological resilience, emphasizing the integrated nature of urban systems. This evolution has led to the development of mature assessment frameworks and indicator systems by organizations such as the Rockefeller Foundation and Cutter et al. [2–3]. Furthermore, big data technologies are extensively applied [4]. Domestic research on urban resilience has developed rapidly, yielding significant outcomes in theoretical exploration, evaluation frameworks, and influencing factors. Scholars such as Shao Yiwen and Xu Jiang, and Zhang Shiju et al. have actively systematized theories and developed evaluation frameworks [5–6]. Specifically for Chongqing Municipality, Hu You et al. have conducted spatiotemporal evolution analyses [7].

1.3.2. Research on high-quality tourism development
The significance of tourism in global and regional economies continues to grow [8]. International research emphasizes tourism efficiency and sustainable development, extensively employing SFA, DEA, and their modified models to measure efficiency, while examining developmental efficiency from a sustainability perspective [9–12].

Research exhibits diversity in scale, data, and methodology. Domestically, against the backdrop of high-quality development principles and deep integration with cultural tourism, high-quality tourism development has become an academic hotspot. Scholars interpret its connotations and construct evaluation systems from dimensions such as innovation, coordination, greenness, openness, and sharing, as exemplified by Peng Shuzhen et al. and He Jianmin [13–14]. Moreover, specific evaluation systems for different tourism formats and regions have been developed, such as by He Yanbing et al. and Yan Youbing and Ouyang Min [15–16]. Regarding influencing factors, Zuo Xin et al. have examined impediments [17].

1.3.3. Research and review on urban resilience and tourism

Within the interdisciplinary field of urban resilience and tourism, existing research has preliminarily examined tourism's recovery capacity following disaster impacts and the significance of urban resilience for tourism destination development. Fan Ningning examined the coupling and driving factors between high-quality tourism development and urban resilience in the Middle Yangtze River Urban Agglomeration, while Hu Qi explored the spatiotemporal evolution characteristics and influencing factors of urban resilience in the Wanjiang Urban Belt [18–19]. However, existing domestic and international research exhibits shortcomings, including insufficient systematic quantitative analysis, scarcity of studies addressing regional variations, and limited case studies. This study aims to address these gaps by focusing on the unique period of profound COVID-19 impact from 2019 to 2023, delving into the interactive evolution of two systems—high-quality tourism development and urban resilience—under external shocks. By constructing a more scientifically comprehensive multidimensional indicator system and employing multiple quantitative analysis methods—including the entropy method, the coupling coordination degree model, and the obstacle degree model—this study conducts refined spatiotemporal evolution and regional disparity analyses using Chongqing's "One Zone and Two Clusters" as the research unit. It identifies key impediments constraining the synergistic development of these systems, thereby providing scientific grounds for formulating tailored policies suited to Chongqing's specific context.

2. Research design and methodology

2.1. Study area and data sources

This study examines Chongqing's "One Zone and Two Clusters" over the period 2019–2023 to analyse pre- and post-pandemic coupling characteristics. Data primarily derive from the Chongqing Statistical Yearbook and publicly available government sources. Missing indicators were supplemented through regional aggregation or proportional allocation to ensure completeness and reliability.

2.2. Construction of the evaluation indicator system

2.2.1. Urban resilience evaluation indicator system

Urban resilience denotes a city system's capacity to effectively withstand, adapt to, recover from, and transform in response to external shocks. To facilitate scientific evaluation, this study adheres to principles of scientific rigour, systematic approach, and operational feasibility. An indicator framework comprising four dimensions—economic resilience, social resilience, ecological resilience, and infrastructure resilience—has been established (**Table 1**), aiming to comprehensively assess urban resilience levels.

Table 1. Urban resilience evaluation indicator system

Indicator	Dimension	Specific indicator	Indicator meaning	Attribute	Reference Source
Urban Resilience	Economic Resilience	Per capita GDP	Reflects regional economic development levels and per capita income, and to some extent indicates the economy's capacity to withstand risks.	Positive	Zhang Shiju et al. [6]
		Share of Tertiary Sector in GDP	This indicator reflects the proportion of the tertiary sector within the economic structure. A higher proportion indicates a more rational regional economic structure and greater stability in economic development.	Positive	Zhang Shiju et al. [6]
	Social resilience	Ageing rate	The ageing rate reflects the proportion of elderly individuals within the total population. Higher values may exert pressure on social security, healthcare services, and labour supply.	Negative	Yang Bihong et al. [20]
		Year-end balance of personal savings deposits (billion yuan)	This indicator reflects residents' economic resilience and risk-bearing capacity.	Positive	Zhang Shiju et al. [6]
	Ecological resilience	Total wastewater discharge × (Total tourism revenue / GDP)	This indicator reflects the combined impact of wastewater discharge pressure on the ecological environment and the level of tourism development. A lower value is preferable, indicating reduced pollution pressure on the ecological environment alongside economic growth.	Negative	Hu You et al. [7]
		Total exhaust emissions × (Total tourism revenue / GDP)	This indicator reflects the combined impact of exhaust gas emissions on the ecological environment and the level of tourism development. A lower value is preferable, indicating that economic development is accompanied by less pollution pressure on the ecological environment.	Negative	Hu You et al. [7]
	Infrastructure Resilience	Road area per capita	This metric reflects the level of regional transport infrastructure development, which, to some extent, indicates economic development and logistics capabilities.	Positive	Zhang Shiju et al. [6]
		Urban road length	Reflects the scale of the urban road network and, to some extent, indicates the sophistication of urban transport infrastructure and transportation capacity.	Positive	Hu Qi [19]

2.2.2. Evaluation Indicator System for High-Quality Tourism Development

High-quality tourism development embodies the new development philosophy within the tourism sector, emphasizing innovation, coordination, green development, openness, and shared benefits. This study constructs an indicator system encompassing five dimensions—innovation, coordination, green development, openness, and shared benefits (**Table 2**)—tailored to regional realities and data availability, aiming to comprehensively reflect the level of high-quality tourism development.

Table 2. Evaluation indicator system for high-quality tourism development in Chongqing

Indicator	Dimension	Specific Indicator	Indicator Meaning	Relevance	Reference Source
High-Quality Development of the Tourism Industry	Innovation	Share of Tourism Revenue in GDP	The proportion of tourism revenue in GDP reflects the tourism industry's standing and contribution within the national economy, demonstrating its role in driving overall economic growth.	Positive	Fan Ningning [18]
		Proportion of Tourism Employment in Total Employment	This metric reflects the tourism sector's contribution to employment, indicating the industry's vitality and developmental prospects.	Positive	Peng Shuzhen et al. [13]
	Coordination	Number of star-rated hotels	Reflects the scale and development level of the tourism service sector, demonstrating the supporting facilities and service quality of the tourism industry.	Positive	Fan Ningning [18]
		Number of Travel Agencies	Reflects the scale and development level of the tourism service industry, demonstrating the supporting facilities and service quality of the tourism sector.	Positive	Fan Ningning [18]
	Green Development	Ratio of days with good air quality	Reflects the level of urban greening and ecological environment quality, embodying the sustainable development philosophy of the tourism industry.	Positive	Wei Zijun et al. [21]
		Energy consumption per ten thousand yuan of GDP	Reflects the energy efficiency and resource consumption levels of regional economic development.	Negative	Wei Zijun et al. [21]
	Openness	Inbound tourist proportion	Reflects the attractiveness to international visitors, indicating the openness and internationalization level of the tourism industry.	Positive	Fan Ningning [18]
		Per capita tourism foreign exchange earnings	Reflects the consumption level of inbound tourists and the added value of tourism products, serving as a key indicator for measuring the foreign exchange earnings efficiency of the tourism industry in the international market.	Positive	Fan Ningning [18]
	Shared Benefits	Cultural Tourism, Sports, and Media Expenditure	Government investment in public services, particularly in areas closely linked to residents' quality of life and tourism experiences, such as culture, tourism, sports, and media.	Positive	Wang Jinwei et al. [22]
		Subject distribution of students in secondary vocational education institutions, Number of graduates (tourism category)	Regional capacity and outcomes in cultivating tourism professionals.	Positive	Zhang Nian [23]

2.2.3. Determination of indicator weights

To objectively reflect the importance of each indicator, this study employs the entropy weighting method. This approach determines weights based on the information content of indicators, thereby avoiding subjective bias. Weights for regional indicators are calculated independently and remain stable between 2019 and 2023 (Tables 3 and 4).

Table 3. Weighting table for urban resilience evaluation indicators

Dimension	Specific indicator	Metropolitan area weight	Three Gorges reservoir area weight	Wuling mountain region weight
Economic Resilience	Per capita GDP (yuan)	0.153723	0.139071	0.128488
	Tertiary Industry Share of GDP	0.160279	0.105869	0.189011
Social resilience	Ageing rate	0.087156	0.099329	0.130495
	Year-end balance of personal savings deposits (billion yuan)	0.127164	0.130465	0.145488
Ecological Resilience	Tourism wastewater discharge intensity	0.085447	0.102784	0.073528
	Tourism Waste Gas Emission Intensity	0.115809	0.133021	0.103443
Infrastructure resilience	Road area per capita	0.165205	0.160157	0.137515
	Urban road length	0.105217	0.129304	0.092032
Total		1.000000	1.000000	1.000000

Table 4. Weighting table for tourism high-quality development evaluation indicators

Dimension	Specific indicator	Metropolitan area weight	Three Gorges Reservoir area weight	Wuling mountain region weight
Innovation	Tourism Revenue as % of GDP	0.051208	0.053337	0.060846
	Percentage of tourism employment relative to total employment	0.085043	0.052397	0.045697
Coordination	Number of star-rated hotels	0.045785	0.050529	0.061417
	Number of travel agencies	0.081021	0.099209	0.134411
Green Development	Percentage of days with good air quality	0.053858	0.104519	0.039985
	Energy consumption per ten thousand yuan of GDP	0.051498	0.082753	0.05446
Openness	Proportion of inbound tourists	0.185468	0.18641	0.200175
	Per capita tourism foreign exchange earnings	0.164905	0.160252	0.181622
Shared Benefits	Expenditure on Culture, Tourism, Sport, and Media	0.121124	0.056741	0.100567
	Number of Graduates by Subject Area in Secondary Vocational Education Institutions (Tourism Category)	0.16009	0.153853	0.12082
Total		1.000000	1.000000	1.000000

2.3. Research methodology

2.3.1. Entropy method

The entropy weighting method is an objective weighting approach that determines weights based on the information content of indicators, thereby avoiding subjective bias. This study employs this method to weight indicators for urban resilience and high-quality tourism development, with weights calculated independently for each region (Tables 3 and 4).

(1) Coupling Coordination Degree Model
1: Calculating Coupling Degree (C)

$$C=\frac{U_1 \cdot U_2}{[\frac{(U_1+U_2)}{2}]^2} \tag{1}$$

U1: Comprehensive urban resilience score
U2: Tourism high-quality development composite score
2: Calculate Coordination Degree (T)

$$T=\alpha U_1 + \beta U_2 \tag{2}$$

3: Calculate Coupling Coordination (D)

$$D=\sqrt{C \cdot T} \tag{3}$$

4: Coupling Coordination Grading (Table 5)

Table 5. Classification criteria for coupling coordination levels

Classification range	Degree of coordination	Coordination effect
D>0.8	Highly Coordinated	The system exhibits a high degree of coordinated development.
0.5≤D≤0.8	Moderate Coordination	The system exhibits a certain degree of coordinated development.
0.3≤D<0.5	Mild Coordination	The system exhibits certain contradictions.
0≤D<0.3	Lack of Coordination	The system exhibits significant contradictions.

(2) Barrier Degree Model
1: Calculate the deviation degree of indicators (I_{ij})

$$I_{ij}=1-X'_{ij} \tag{4}$$

Where, I_{ij} denotes the deviation degree of the th indicator in the year; X'_{ij} denotes the standardised value of the th indicator in the year i, typically ranging between [0,1]. A higher value indicates greater deviation from the optimal state and stronger constraints on system development.

2: Calculating indicator contribution

$$W'_j=w_j \tag{5}$$

Where W'_j denotes the contribution of the jth indicator to its respective system (urban resilience or high-quality tourism development), i.e., the indicator's weight; w_j represents the weight of the jth indicator calculated using the entropy method.

3: Calculating the indicator's degree of difficulty (O_j)

$$O_{ij}=\frac{I_{ij} \cdot w_j}{\sum_{j=1}^{n}(I_{ij} \cdot w_j)} \times 100\% \tag{6}$$

Where: O_{ij} represents the obstacle level for the th indicator in the year i; I_{ij} denotes the indicator deviation; W_j

represents the indicator weight; $\sum_{j=1}^{n} (I_{ij} \cdot w_j)$ indicates the sum of all indicator deviation-weight products.

4: Obstacle Degree Analysis

Identify indicators with high obstacle degrees, representing key constraints to coordinated development. Analyze the causes of these obstacles and propose targeted policy recommendations.

2.3.2. Spatio-temporal analysis method

By comparing the coupling coordination degree and obstacle degree across different years and regions, the study analyzes their spatio-temporal evolution characteristics and regional disparities.

3. Spatiotemporal analysis of coupling coordination between high-quality tourism development and urban resilience in Chongqing Municipality (2019–2023)

3.1. Temporal evolution analysis of urban resilience, high-quality tourism development, and coupling coordination

During the study period, the coupling coordination degree between urban resilience and high-quality tourism development in Chongqing's "One Zone and Two Clusters" generally exhibited characteristics of "a widespread trough under external shocks followed by resilient recovery, accompanied by significant regional imbalances." From 2019 to 2021, the pandemic shock led to a widespread decline or stagnation at low levels in coordination across all regions, with tourism vulnerability being particularly pronounced. However, urban resilience generally strengthened during this period, providing a foundation for subsequent recovery. Between 2022 and 2023, coordination levels across regions recovered actively, with the metropolitan area being the first to achieve "good coordination." Although the Dasanxia (Three Gorges) and Dawuling (Wuling) regions demonstrated significant resilience gains, their coordination levels improved relatively slowly, largely remaining at "initial coordination" or "barely coordinated" stages. This regional disparity highlights differences in how areas at varying developmental stages respond to external shocks and pursue coordinated development, underscoring the need for tailored future strategies (Figures 1–3)
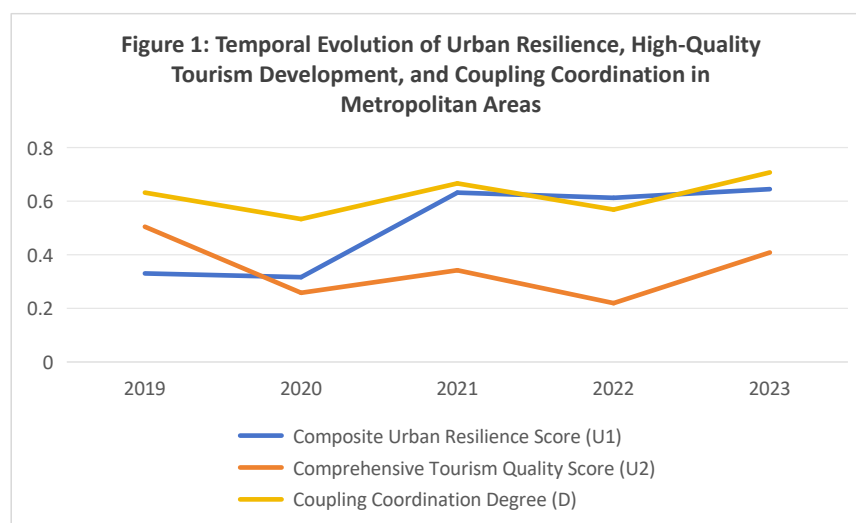

Figure 1. Temporal evolution of urban resilience, high-quality tourism development, and coupling coordination in metropolitan areas
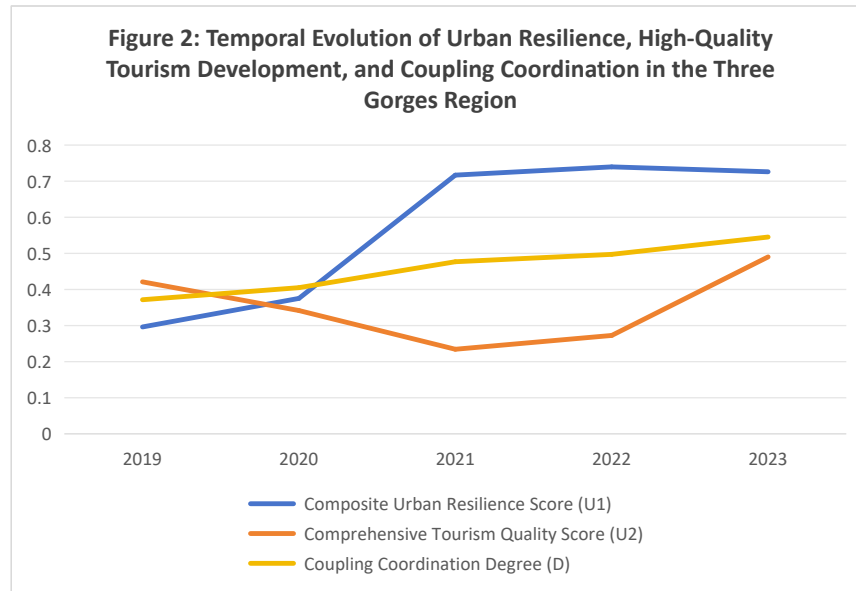
Figure 2. Temporal evolution of urban resilience, high-quality tourism development, and coupling coordination in the Three Gorges region
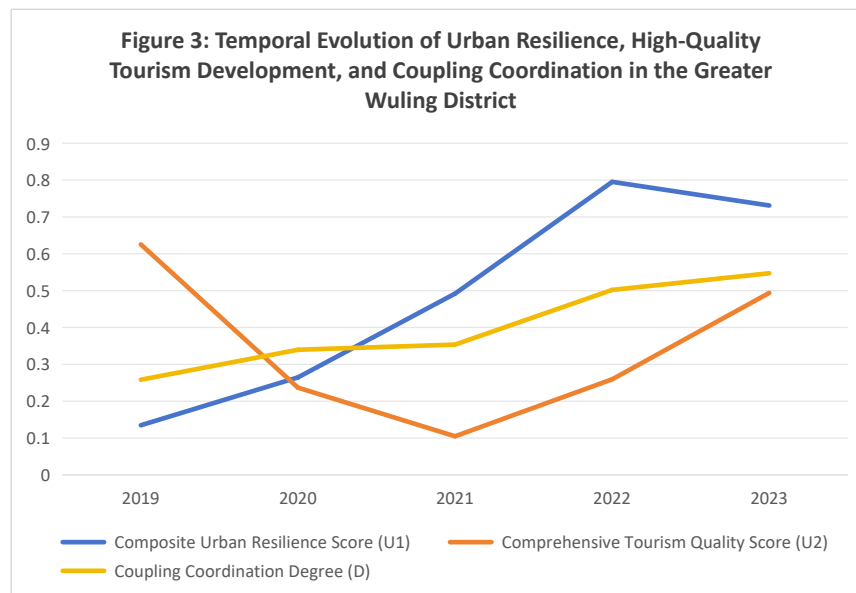

Figure 3. Temporal evolution of urban resilience, high-quality tourism development, and coupling coordination in the Greater Wuling District

3.2. Regional variations in coupling coordination

The coupling coordination degree (D) between urban resilience and high-quality tourism development across Chongqing Municipality's "One Zone and Two Clusters" exhibited pronounced regional disparities from 2019 to 2023, reflecting differing capacities to withstand external shocks and divergent development trajectories (Figures 4–8). In 2019, the Metropolitan Area demonstrated a moderate level of coordination, with relatively high scores for both resilience and tourism development. The Greater Wuling Area recorded the lowest Dvalue, indicating lagging resilience. During the initial phase of the COVID-19 pandemic (2020), coordination declined across all regions:

the Metropolitan Area experienced the largest tourism shock, whereas resilience in the Greater Three Gorges Area remained comparatively stable. Throughout the prolonged pandemic period (2021–2022), the Metropolitan Area's resilience improved substantially, and it led the recovery of tourism; although resilience in the Greater Three Gorges and Greater Wuling areas reached peak levels, persistent damage to their tourism sectors continued to constrain their coupling coordination. By 2023, as pandemic impacts waned, the Metropolitan Area achieved a high level of coordination; the Greater Three Gorges and Greater Wuling areas' Dvalues rose to a marginally coordinated level, with notable improvements in both resilience and tourism development that narrowed—but did not eliminate—the gap with the Metropolitan Area. This pattern, in which core areas attain high-level coordination earlier while less developed regions show pronounced resilience but lagging tourism, underscores the need for differentiated, targeted strategies to promote higher-level, balanced coordination across the municipality.
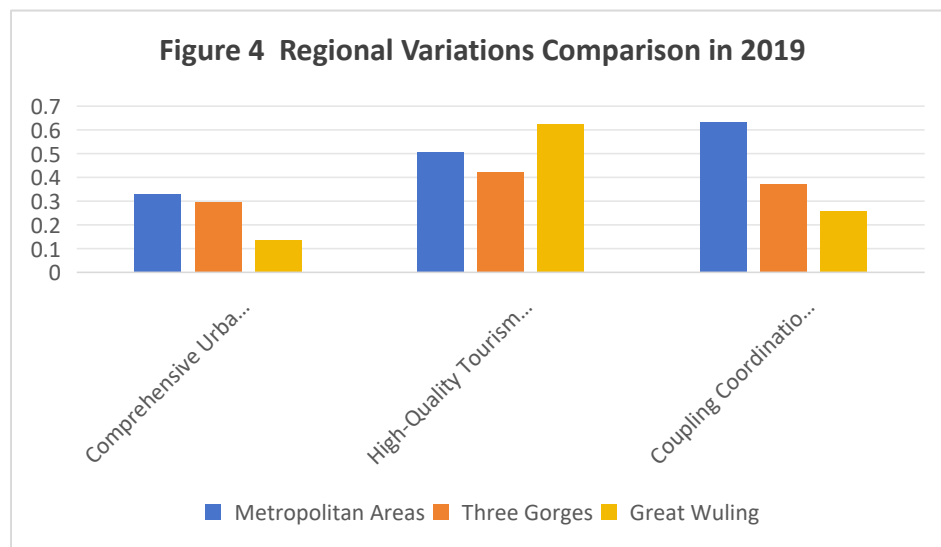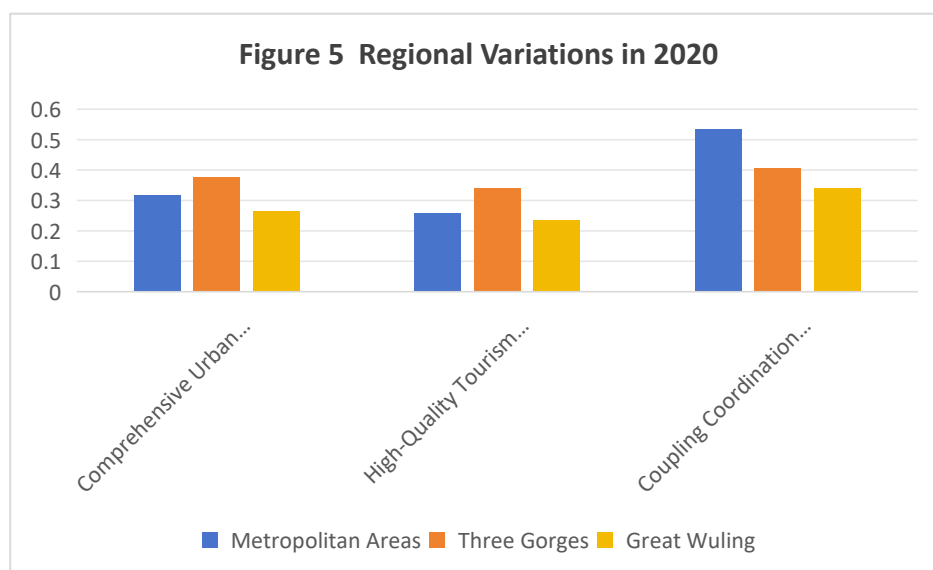

Figure 4. Regional variations comparison in 2019

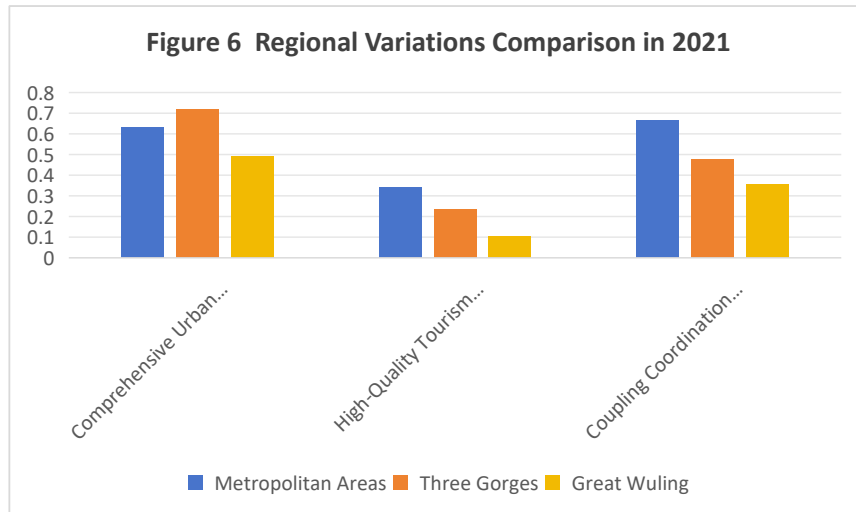**Figure 5.** Regional variations in 2020

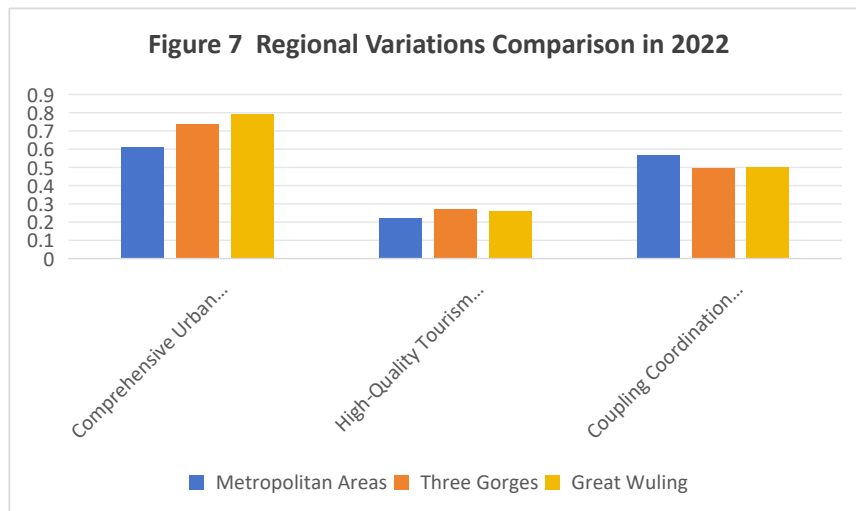**Figure 6.** Regional variations comparison in 2021

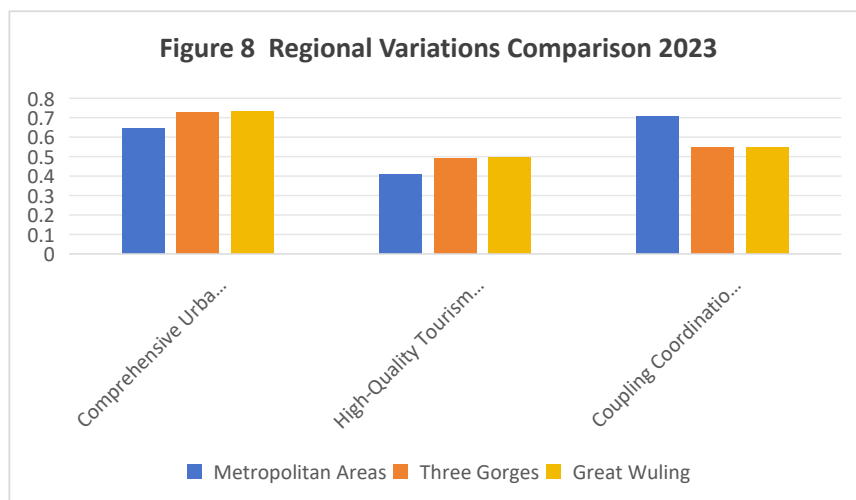**Figure 7.** Regional variations comparison in 2022

Figure 8. Regional variations comparison 2023

4. Analysis of barriers to coupling coordination between high-quality tourism development and urban resilience in Chongqing's "one zone, two clusters" framework (2019–2023)

4.1. Analysis of urban resilience system barriers

Barriers to urban resilience within Chongqing Municipality's "One Zone and Two Clusters" exhibit significant regional heterogeneity. In the Metropolitan Area, primary constraints have shifted from economic development and public service provision toward the coordination of ecological protection and social stability. The Greater Three Gorges Area faces persistent shortcomings in infrastructure and innovation capacity, alongside mounting pressures for ecological conservation. As a less-developed region, the Greater Wuling Area continues to confront core resilience challenges, including low economic development, inadequate public services, outmigration, and shortages of skilled personnel. Although economic development levels and public service provision are common obstacles across the "One Zone and Two Clusters", each region presents distinct critical issues, underscoring the need for tailored, place-based resilience-building measures.

4.2. Analysis of systemic barriers to high-quality tourism development

The impediments to high-quality tourism development within Chongqing Municipality's "One Zone and Two Clusters" exhibit distinct regional characteristics and dynamic evolution. In the Metropolitan Area, primary obstacles have shifted from the initial pandemic-induced sharp decline in market size and tourism revenues to insufficient tourism product innovation and difficulties in improving service quality, indicating the need for in-depth, quality-oriented development. As an ecological tourism zone, the Greater Three Gorges Area has long faced lagging infrastructure and limited brand recognition, driven by poor transportation accessibility, inadequate promotion, and overreliance on a single natural resource base. The Greater Wuling Area confronts severe challenges due to a single-industry structure, shortages of skilled personnel, and inadequate supporting infrastructure, with these vulnerabilities becoming especially evident during the pandemic. Across the "One Zone and Two Clusters", lagging market adaptability and product innovation are common problems; however, each region exhibits distinct weaknesses in infrastructure, brand building, and talent cultivation, underscoring the need for differentiated, place-based strategies.

4.3. Comprehensive analysis of coupling coordination barriers

A comprehensive analysis of impediments within the urban resilience and high-quality tourism systems indicates that Chongqing Municipality's "One Zone and Two Clusters" face core barriers stemming from the interaction of systemic shortcomings and factor misallocation driven by regional development imbalances. Less-developed areas, notably the Greater Three Gorges Area and the Greater Wuling Area, encounter resilience constraints—such as low economic development and inadequate public services—that directly restrict tourism infrastructure, industrial upgrading, and talent attraction, causing high-quality tourism development to lag and further undermining regional economic vitality. Weak infrastructure reduces tourism accessibility, and shortages of skilled personnel limit product innovation. Even in the Metropolitan Area, unresolved higher-order resilience challenges—including ecological quality and social stability—can weaken tourism appeal. These interlinked obstacles jointly hinder high-level coupling coordination between urban resilience and high-quality tourism development.

5. Conclusions and policy recommendations

5.1. Research findings

This study reveals the spatiotemporal evolution of the coupling coordination degree (D) between urban resilience and high-quality tourism development across Chongqing Municipality's "One Zone and Two Clusters." During the study period, coordination levels in all regions experienced a general downturn under external shocks followed by resilience-driven recovery, with most areas returning to or exceeding pre-pandemic levels by 2023. Concurrently, significant regional disparities emerged: the Metropolitan Area achieved high-level coordination first and demonstrated stronger resilience, whereas the Greater Three Gorges and Greater Wuling areas— despite marked improvements in urban resilience—registered relatively slower coordination gains due to lagging tourism recovery and structural developmental differences. Comprehensive impediment analysis indicates that underdeveloped regions primarily face systemic shortcomings in urban resilience (for example, low economic development and insufficient public service provision) together with factor misallocation in tourism infrastructure and human capital; these constraints interact and mutually reinforce one another. The Metropolitan Area, in contrast, encounters higher-order resilience challenges—notably ecological quality and social stability—as well as pressures to innovate tourism offerings and enhance service quality. Overall, against the backdrop of regional development imbalances, the interaction of systemic shortcomings and factor misallocation jointly impedes high-level coupling coordination between urban resilience and high-quality tourism development.

5.2. Policy recommendations

To achieve high-level coupling coordination between high-quality tourism development and urban resilience in Chongqing Municipality's "One Zone and Two Clusters," policy formulation must strengthen integrated top-level planning and collaborative mechanisms. Enhancing urban resilience requires optimizing industrial structures, improving social security, strengthening ecological conservation (especially in high-emission areas), and sustaining infrastructure investment, particularly to address road deficiencies. Promoting high-quality tourism involves fostering innovation in products and business models to enhance value-added (for high-energy-consumption, low-revenue areas), optimizing service facilities and boosting international appeal (for regions with low inbound visitors and foreign exchange earnings), increasing cultural and sports expenditure, strengthening talent cultivation, and ensuring inclusive benefit sharing. Differentiated strategies are crucial: the Metropolitan Area should focus on high-end services, innovation, and ecological governance, while the Greater Three Gorges and Greater Wuling regions must prioritize addressing deficiencies in infrastructure, public services, and talent, vigorously developing eco-tourism for endogenous growth.

5.3. Research outlook and limitations

This study has made progress in analyzing the coupling and coordination between urban resilience and high-quality tourism development within Chongqing Municipality's "One Zone and Two Clusters" framework, yet certain limitations remain. Future research could expand the time series and research scope to include more cities or districts, incorporate additional models such as geographic detectors to analyze driving factors, or conduct more micro-level case studies. Key shortcomings primarily include potential limitations in data acquisition due to data availability and statistical caliber, possible under-representation of all influencing dimensions in indicator selection, and the inherent constraints of coupling coordination models in elucidating specific mechanisms and impact pathways.

Disclosure statement

The author declares no conflict of interest.

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