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# Regional Tourism Resilience under Crisis Impacts: The Cases of Yangtze River Delta and Pearl River Delta

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## ABSTRACT

Since the beginning of the 21st century, various crisis events have occurred frequently, inflicting substantial impacts on the tourism sector, which has garnered considerable scholarly and policy attention. Nevertheless, limited research has systematically explored tourism resilience at the urban scale, and there is a paucity of studies comparing regional differences in tourism resilience under distinct crisis scenarios and their underlying causes. Thus, this study focuses on the Yangtze River Delta and the Pearl River Delta, employing Martin's regional economic resilience measurement method. It assesses the tourism resilience of the two regions under the impact of the 2008 financial crisis and the COVID-19 pandemic, subsequently visualizing the data results using ArcGIS software. The study also endeavors to unveil potential causes for disparities in urban tourism resilience. The main conclusions are as follows: Firstly, regions with higher economic development exhibit relatively weaker tourism resilience during economic crises, yet demonstrate comparatively stronger resilience during public crises. Secondly, distinct differentiations exist both between and within the Yangtze River Delta and the Pearl River Delta, primarily stemming from variations such as geographical positioning, tourism resource endowments, and industrial and economic structures, both regionally and within individual cities. Thirdly, the determination of regional tourism resilience is intricate and cannot be restricted to a single dimension; multidimensional indicators better encapsulate the essence of regional tourism resilience.

***Keywords:*** Tourism resilience; Financial crisis; COVID-19; Impact of crisis events; Spatial differences

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# 1. Introduction

In recent years, the urban tourism sector in China has undergone substantial growth owing to the expanding demand for tourism in conjunction with the advancement of socio-economic progress. Nevertheless, the tourism industry operates as an intricately interlinked sector, characterized by notable inter-industry associations and a pronounced reliance on interconnected factors. This complex structure renders it highly susceptible to the influence of extraneous influences and unanticipated crises. As a consequence, the tourism sector often exhibits heightened vulnerability, rendering it susceptible to external shocks, such as the SARS epidemic in 2003, the global financial crisis in 2008, and the worldwide COVID-19 pandemic in 2019. The resultant economic repercussions stemming from these crises underscored the fragility inherent in the tourism industry. This fragility, in turn, had emerged as a pivotal determinant influencing the sustainable and qualitative progression of the sector. Therefore, addressing these challenges warrants profound consideration and engagement from all strata of society.

There has been an increased scholarly interest in the investigations of tourism resilience. Most of the extant research on tourism resilience predominantly has focused on the destination level, often confined to assessing the suitability for ongoing tourism activities. However, there remains a significant lacuna in the resilience of the tourism industry at the urban scale, further compounded by the absence of comparative analyses concerning regional variations. Consequently, in the context of specific external perturbations, what distinctions and variations might emerge in tourism resilience across diverse regional economic entities? How does the resilience and recuperation trajectory of the tourism sector diverge from that of other industries in the face of uncertain extrinsic economic and public health shocks? Moreover, what discernible features characterize the tourism resilience among urban entities within regional economies? Is there a tendency towards convergence in trends between urban and regional economic entities? As industries undergo transformative upgrades and the imperative of sustainable tourism development gains prominence, addressing these questions assumes paramount importance.

Therefore, this study selects the Yangtze River Delta and the Pearl River Delta as research subjects, scrutinizing their respective tourism resilience and disparities in the face of financial crises and the impacts of the COVID-19 pandemic. The rationale behind this choice stems from the contemporaneous phenomenon where China's regional spatial arrangement is undergoing transformative cycles characterized by the recalibration of resources and the dynamic interplay between nascent and established forces, thereby synergistically driving fluctuations in urban ascendancy and decline. Consequently, the exploration into the resilience of the tourism sector within China's preeminent urban agglomerations holds the inherent capacity to engender pioneering insights into adept responses to multifaceted crises and challenges. Moreover, the Yangtze River Delta and the Pearl River Delta are two pivotal regional economic entities and urban clusters in China, with their tourism industries holding significant nationwide prominence, rendering them representative samples.

This paper employs a multifaceted approach that considers various dimensions including crisis types and industrial disparities, with the aim of bridging the existing research gap in comparative analyses of tourism resilience among regional economic entities and unveiling differentials and underlying rationales inherent to the tourism development within different urban clusters. By doing so, this research contributes to the formulation of strategic measures and recommendations conducive to fostering sustainable advancement within the tourism industry.

# 2. Literature review

## 2.1 Resilience in tourism

The term "resilience" originated from the Latin word "resilience" and initially found application within physics, engineering, and allied disciplines. It denoted the capacity of a material to restore its initial configuration and functionality after defor-

mation induced by an external force. Subsequently, the ecological domain incorporated the terminology "resilience", introduced by Holling [1] to characterize a system's adeptness in adapting to and recuperating from disturbances. Further advancing this discourse, Price [2] discerned that the ecosystem's resilience dynamically evolves alongside the ecosystem's progression, manifesting varying attributes across distinct developmental stages. Consequently, grounded in the conceptual framework of panarchy, the perspective of evolutionary resilience emerged, connoting the process through which systems exhibit adaptive resistance to shocks over time. The term "evolutionary resilience" signified this perspective. Remarkably illustrative of the system's capacity to withstand perturbations, this notion transcended the domain of ecology and extends its utility to diverse fields such as psychology, economics, and urban planning [3,4].

Prior to the conceptualization of tourism resilience, Butler [5] introduced the pioneering "Tourism Life Cycle" (TALC) model, which posited that the developmental trajectory of a tourism destination generally encompasses six sequential phases—exploration, involvement, development, consolidation, stagnation, and decline (or rejuvenation). This evolving progression may engender deterioration in environmental integrity and a diminished visitor experience. Within this framework, recovery and resurgence emerge as pivotal junctures that account for both environmental and economic dynamics. Resilience, in turn, elucidates the cyclicality and intricate nature of the tourism life cycle [6]. Foreign scholars exhibited varied interpretations of tourism resilience, albeit converging on its core focus, namely the resilience of tourism destinations or the tourism sector in the aftermath of disruptive events [7].

## 2.2 The origin and development of tourism resilience

Since the mid-1990s, foreign scholars have emphasized the vulnerability of tourism and gradually introduced resilience into the tourism field. Sharpley [8] noted that the vulnerability of tourism to socioeconomic and environmental shocks (fast events) and stressors (slow events) has been widely recognized. Faulkner [9] believed that due to the complexity of the tourism system and its inherent fragility, external threats such as natural disasters or social, political and economic crises tend to have a great impact on tourism activities. Based on clarifying the vulnerability of tourism, scholars have further emphasized the importance of tourism resilience for tourism development. Tyrrell and Johnston [10] saw tourism resilience as part of a broader tourism sustainability issue. Espiner et al. [11] also linked tourism resilience to sustainable development, arguing that sustainable destinations are those with high resilience and stating that resilience can be seen as a "buffer" or "lubricant" to achieve sustainable development mechanisms, emphasizing the importance of resilience in sustainable development. Watson et al. [12] noted that in regions where major employment and income come from the tourism industry, the resilience of the tourism industry represents the economic resilience of the region. These topics are related to the concept of resilience that has been discussed in the tourism literature, which points to the resilience of the tourism industry itself. While attention has been paid to the importance of tourism resilience for sustainable regional development, the literature has neglected tourism resilience in areas where tourism development is weak.

Existing tourism-focused resilience research typically conceptualizes resilience theoretically [13] or assesses resilience based on the qualitative experiences and perceptions of individual or collective stakeholders [14]. There were also studies that used quantitative data to measure tourism resilience, but most of them focused more on the supply side of tourism based on the economic characteristics of resilience, which may overlook the fact that tourism resilience itself is one of the influencing factors of economic resilience [15,16]. In a typical quantitative data study, Song et al. [17] employed deductive theoretical models, or computable general equilibrium models, as the primary method for estimating the "macroeconomic" impacts of tourism and hospitality. Models of this type were

based on Keynesian and Walrasian models and described the circular flow of the economy. Tourism is an export sector, and tourists bring revenue to the tourism economy, which is circulated through the economy through a multiplier effect. It is instructive that the measurement of tourism resilience may have to take into account more dimensions, encompassing the production side and the consumption side.

In addition, the role of tourism resilience is currently being explored by a number of scholars. Morakabati [18] confirmed that the recovery of tourism is more resilient than that of the overall economy. Sharma et al. [19] concluded that tourism has rebounded rapidly after disasters and epidemics such as Ebola, Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). Wang et al. [20] argued that if tourism becomes a pillar industry, the vulnerability of tourism means economic vulnerability. Watson and Deller [12] discovered that under the influence of the COVID-19 pandemic and after vaccines and medicines are popularized, tourism regions that rely more on local tourists have a greater contribution to economic resilience. Gaki and Koufodontis [21] examined the economic resilience of the Greek tourism industry from a quantitative perspective under the impact of the financial crisis and the COVID-19 pandemic, focusing on tourism employment data. By calculating the resistance index and recovery index, the special economic resilience of Greece was reflected in the fact that the mainland region, including the large cities, was not necessarily the most resilient region for the tourism economy; on the contrary, the regional resilience that relied on tourism development seemed to be stronger than other regions. Synthesizing the literature above, it can be seen that while tourism resilience has a role to play in helping regional economies recover, this role may hold under certain conditions, such as a certain type of crisis, or a region that has reached a certain level of economic development. There is a certain ambiguity, and the specific role of tourism resilience may be further explored by comparing different types of crises and different regions.

Therefore, with the help of multi-dimensional quantitative data, this study hopes to discover the performance of tourism resilience in the YRD and PRD, taking the financial crisis of 2008 and COVID-19 as examples, with a view to defining the specific conditions under which tourism resilience plays a specific role, and providing new perspectives for measuring tourism resilience.

# 3. Methodology

## 3.1 Regional general situation

The Yangtze River Delta and the Pearl River Delta constitute two prominent urban agglomerations in China, characterized by their elevated levels of economic development and flourishing tourism industries (**Figures 1-3**). As shown in **Figure 1**, situated in the southern region of China, the Pearl River Delta is adjacent to Hong Kong and Macau, boasting advanced manufacturing and modern service bases with global influence. This region encompasses a total of nine cities: Shenzhen, Guangzhou, Zhuhai, Foshan, Dongguan, Zhongshan, Zhaoqing, Jiangmen, and Huizhou. Conversely, the Yangtze River Delta is positioned along the eastern coastal area of China and has evolved into the country's foremost financial industry cluster and technological innovation hub (**Figure 2**). It comprises 27 cities, including Shanghai, and cities from Jiangsu Province (Nanjing, Wuxi, Changzhou, Suzhou, Nantong, Yangzhou, Zhenjiang, Yancheng, and Taizhou), Zhejiang Province (Hangzhou, Ningbo, Wenzhou, Huzhou, Jiaxing, Shaoxing, Jinhua, Zhoushan, and Taizhou), as well as Anhui Province (Hefei, Wuhu, Ma'anshan, Tongling, Anqing, Chuzhou, Chizhou, and Xuancheng).

The distinct geographical positioning and economic development models of these two regions, alongside the intricate and diverse economic structures of cities within each region, underline their inherent differences (**Figure 3**). These variations contribute to the potential divergence in their responses to shocks, rendering them highly comparable entities when considering their respective contexts. Furthermore, the population density and economic density

of these two regions are much higher than the national average level, which means that the issue of the region's economic and tourism resilience is particularly important in the current unstable situation.

### 3.2 Methods

In terms of methodology, this study draws on Martin's method of measuring regional economic resilience [22] , which has gained some consensus. This method not only examines the relative resilience of each study region or city in response to shocks when they occur but also measures the divergence in the economic performance of each study region or city when shocks do not occur at ordinary times. The calculation formula is derived as follows.

$$\Delta Y_i = Y_i^t - Y_i^{t-k} \quad (1)$$

$$\Delta \mathbf{E} = \left(\frac{\mathbf{Y}_r^t - \mathbf{Y}_r^{t-k}}{\mathbf{Y}_r^{t-k}}\right) \mathbf{Y}_i^{t-k} \quad (2)$$

Equation (1): $\Delta Y_i$ is the actual economic performance of the research object *i* (city or economic region), $Y_i^t$, $Y_i^{t-k}$ are the quantity index of the research object i at the period of *t*, *t* – *k*;

Equation (2): $\Delta \mathbf{E}$ based on the overall economic performance of the region where the research object is located, predicted economic performance of the research object *i*, $Y_i^t$, $Y_i^{t-k}$ are the quantity index of the region (economic region or whole country) where the research object is located at the period of *t*, *t* – *k*.

$$Resis_i^t = (\Delta \mathbf{Y}_i - \Delta \mathbf{E}) / |\Delta \mathbf{E}| \quad (3)$$

Equation (3): $Resis_i^t$ is the relative economic resilience of the research object *i* at *t* time; for the convenience of operation, Equations (1)-(3) can be combined and simplified as follows:

$$Resis_i^t = \frac{(Y_i^t - Y_i^{t-k})/Y_i^{t-k} - \left(\mathbf{Y}_r^t - \mathbf{Y}_r^{t-k}\right)/\mathbf{Y}_r^{t-k}}{\left|\left(\mathbf{Y}_r^t - \mathbf{Y}_r^{t-k}\right)/\mathbf{Y}_r^{t-k}\right|} \quad (4)$$

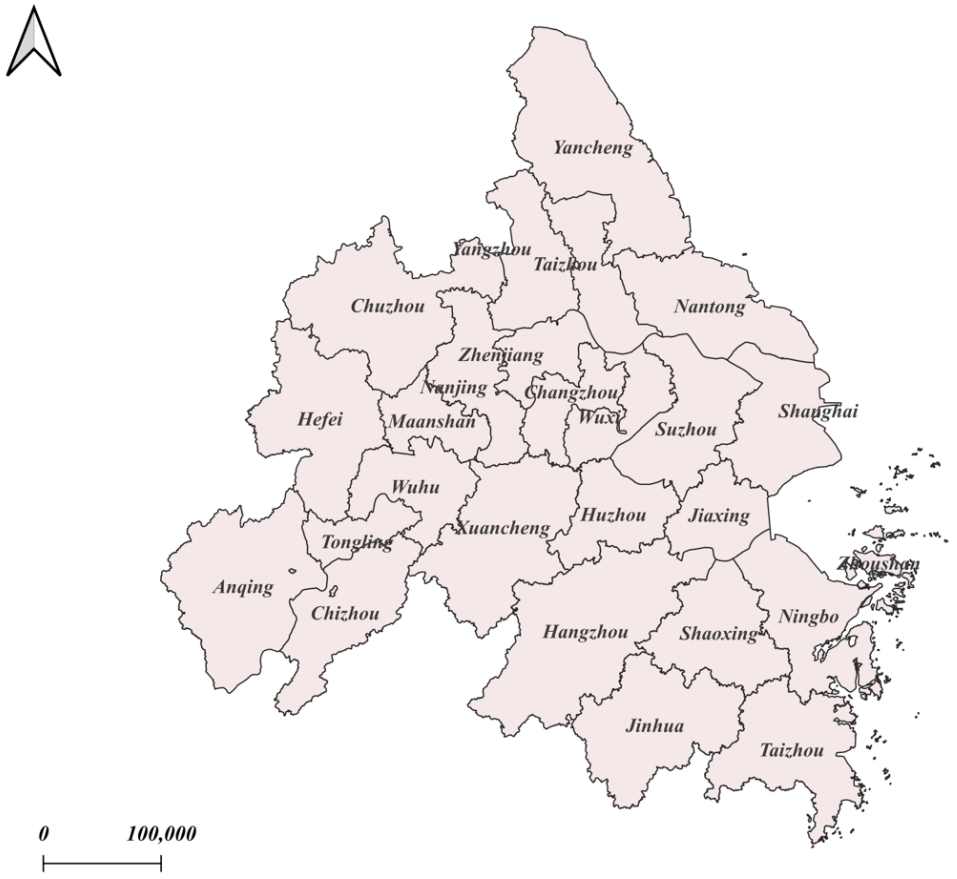


**Figure 1**. Map of cities in the Yangtze River Delta.


**Figure 2**. Map of cities in the Pearl River Delta.

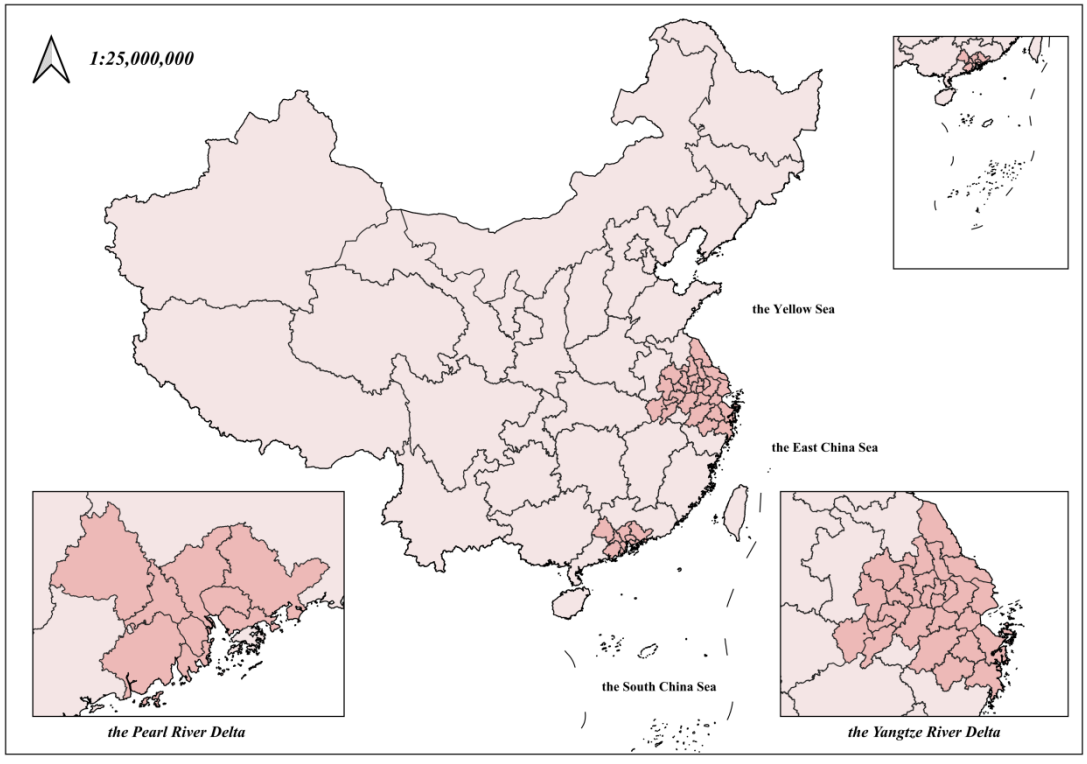


**Figure 3**. The macro-location of the Yangtze River Delta and Pearl River Delta.

To facilitate comparative analysis among all study subjects, the results can be centralized:

$$\mathbf{R}_i = \left( \boldsymbol{Resis}_i^t - \sum_i^n \frac{\boldsymbol{Resis}_i^t}{\boldsymbol{n}} \right) (-\mathbf{1})^{\boldsymbol{p}} \quad (5)$$

Equation (5): n is the total number of research objects; $(-1)^p$ is the correction coefficient, when the selected economic indicators are ordinary indicators (such as GDP, industrial value added, etc.) p = 0, when the selected indicators are negative indicators (such as the unemployed population, the number of closed enterprises, etc.) p = 1; so far, $\mathbf{R}_i$ can be directly used to compare the relative economic resilience of the degree of economic resilience of each research object, when $\mathbf{R}_i > 0$, the economic performance of the research object *i* exceeds the average level of the economic performance of the region, and the larger the value means that the economic resilience of the research object performs better in the region; when $\mathbf{R}_i < 0$, the economic performance of the research object *i* is lower than the average level of the economic performance of the region, and the smaller the value means that the economic resilience of the research object performs worse in the region. By bringing the collected data into Equations (4) and (5), the economic performance of each city or component of the Pearl River Delta and Yangtze River Delta can be compared. When a shock occurs, the resilience of each city in response to the shock can be compared.

### 3.3 Data sources

The data in this paper primarily originate from sources including the "Guangdong Statistical Yearbook" (1999-2019), statistical yearbooks from various cities within the study regions, and databases of the National Bureau of Statistics, spanning the timeframe from 1999 to 2021. To provide a preliminary understanding of the overall resilience comparison between the Pearl River Delta and the Yangtze River Delta at a macro level, this study initially selected the value added of industries including hotel and catering services, manufacturing, wholesale and retail trade, transportation, storage and communications, as well as agriculture, forestry and fishing. The overall regional resilience was then computed based on these indicators.

Besides, tourism, being a service industry, displays an inherent unity of production and consumption. This signifies that while tourism providers generate or offer products and services, tourists simultaneously engage in the purchase of these tourism products and services, thus completing a full production-consumption cycle. Consequently, when assessing the resilience of a region's tourism sector, it becomes imperative to incorporate indicators from both production and consumption aspects. This approach ensures a comprehensive and precise capture and depiction of the regional tourism industry's resilience. Specifically, the value-added of the hotel and catering services sector is employed to represent the production-oriented aspect of tourism resilience. Meanwhile, tourist numbers and tourism revenue are used to signify the consumption-oriented aspect of tourism resilience. Subsequently, the relative resilience of the tourism industry within the Yangtze River Delta and the Pearl River Delta has been quantitatively computed, followed by the utilization of ArcGIS software for visualization purposes.

## 4. Research findings

### 4.1 Regional resilience in general

As illustrated in **Figures 4 and 5**, the vertical comparison of the growth rates of various sectors in the Yangtze River Delta and the Pearl River Delta shows that from 1999 to 2021, the economic development of both regions as a whole exhibited an upward trend with an average annual growth rate maintained at around 10%. This result indicates that the equivalent overall economic scale and similar development dynamics of the two regions, rendering their comparability in nature.

In terms of specific years, the economic growth rates of the two regions both in 2009 and 2020 experienced a significant decline, even turning negative, which was inextricably linked to the global financial crisis in 2008 and the outbreak of COVID-19 in

2019. This suggests that both crises had significant negative impacts on the economic development of the two regions. In contrast, the economies of these two regions recovered in 2010 and 2021, both of which were resilient enough to withstand the crisis in a relatively short period of one year. It implies that the selected time periods for this study have a socially realistic basis, which are 2009-2010 and 2019-2020.

It is worth noting that the growth rate of hotels and catering services, which partly represent tourism, differed between the two regions under the two crises. During the financial crisis, the tourism industry in the Pearl River Delta was hit harder than that in the Yangtze River Delta. Under the influence of COVID-19, the tourism industry in both regions suffered a very significant impact compared with other sectors. The following section analyses the resilience of the tourism industry in the two regions during the two crises.

## 4.2 Comparison of the tourism resilience at the production level in the two regions

### *During financial crisis*

During the financial crisis, notable disparities in tourism resilience between the Pearl River Delta (PRD) and the Yangtze River Delta (YRD) regions became evident (**Figure 6**). Compared to the YRD, the PRD suffered more pronounced shocks and presented weaker tourism resilience. More than half of the cities in the PRD have negative tourism resilience values, with two cities exhibiting resilience values below –1.5, lower than the corresponding figures in the YRD. Furthermore, the inter-city variance in tourism resilience within the PRD was significantly pronounced, characterized by a broader range of values (close to 2 for the highest and approximately –2.4 for the lowest), in contrast to the YRD (with resilience values ranging from 1.2 to –1.6).

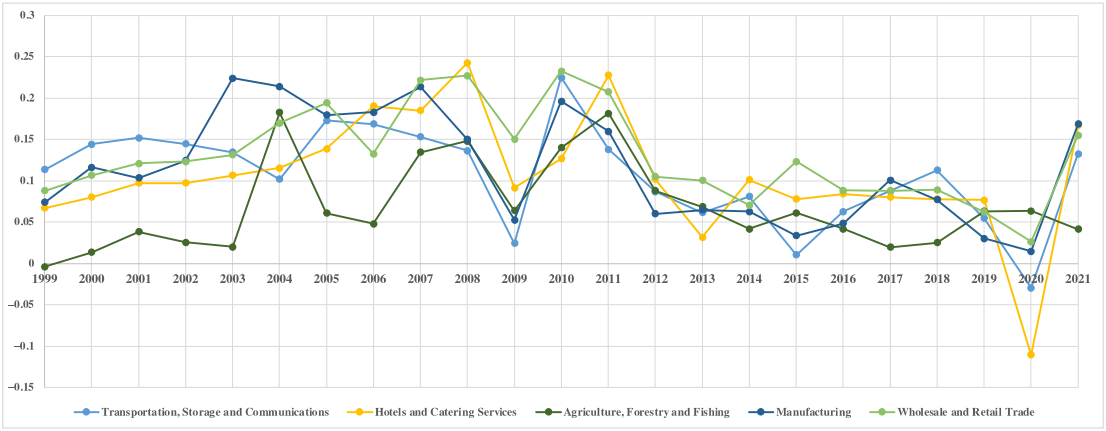


**Figure 4**. YRD's sector growth rates in 1999-2021.

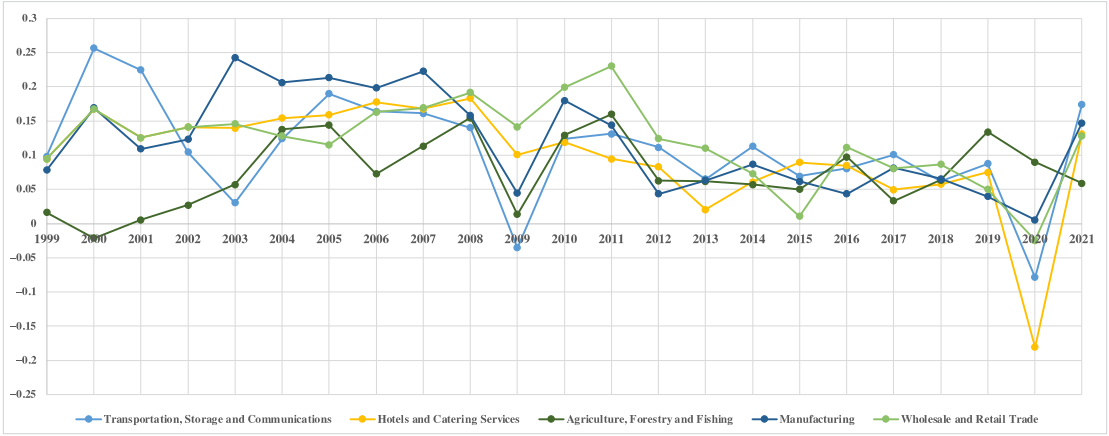


**Figure 5**. PRD's sector growth rates in 1999-2021.

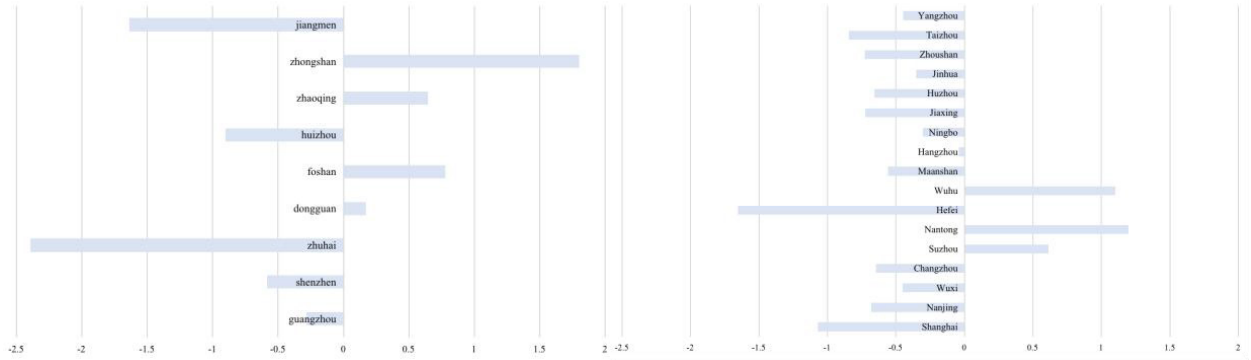


**Figure 6.** PRD and YRD's tourism resilience at the production level during the financial crisis.

This divergence is attributed to the PRD's outward-oriented economy, deeply embedded in the global production network. As such, the PRD's economic development is intricately linked to global economic activities, rendering it more susceptible to fluctuations in the global macroeconomic landscape. Thus, during the financial crisis, the pronounced impact of the crisis on the global economy, coupled with the PRD's integral role within the global production network, resulted in a forceful blow to the PRD's economy. Persistent crisis conditions led to severe regional economic contraction, elevated unemployment rates, reduced household income, and consequently, diminished tourism consumption revenue, directly impacting the tourism industry. However, due to the PRD's complex and diverse economic structure, significant disparities in geographical positioning, endowment of tourism resources, industrial economic structures, and modes of economic development among its cities, distinct responses to the financial crisis ensued, resulting in conspicuous inter-city variance in tourism resilience.

In contrast, the tourism resilience of the YRD demonstrated relatively higher stability, characterized by lower degrees of inter-city tourism resilience differentiation. Compared to the PRD, a broader spectrum of cities within the YRD manifests weaker tourism resilience and a more pervasive negative impact. This outcome could be attributed to the YRD's richer and more diversified endowment of tourism resources, along with a higher level of maturity in urban tourism development. Consequently, in the face of the financial crisis, the YRD cities collectively experienced a broader shock. Yet, due to the YRD's economic structure not being predominantly outward-oriented, its reliance on global economic development is lower, resulting in a limited scope and depth of the impact from external economic shocks, thus leading to comparatively stable tourism resilience.

Moreover, it is imperative to acknowledge certain commonalities in tourism resilience between the two regions during the financial crisis, such as weaker tourism resilience observed in the super first-tier cities and cities with tourism as a foundational industry, as well as stronger tourism resilience demonstrated in manufacturing cities with a robust industrial base.

Overall, within the context of the financial crisis, substantial differentials in tourism resilience become evident between the YRD and the PRD regions.

### *During COVID-19*

During the COVID-19 pandemic, the overall resilience of tourism between YRD and PRD regions displays a notable similarity, with marginal disparities (**Figure 7**). Cities within both regions experienced distinct disruptions in their tourism sectors, evidenced by a predominant manifestation of negative resilience values.

Delving into the specifics, the observed resilience in urban tourism across the YRD and the PRD leads to the following results:

In both regions, the tourism resilience of metropolitan areas and cities that rely heavily on tourism as a foundation industry has declined. Notably, prominent cities such as Shanghai in the YRD and

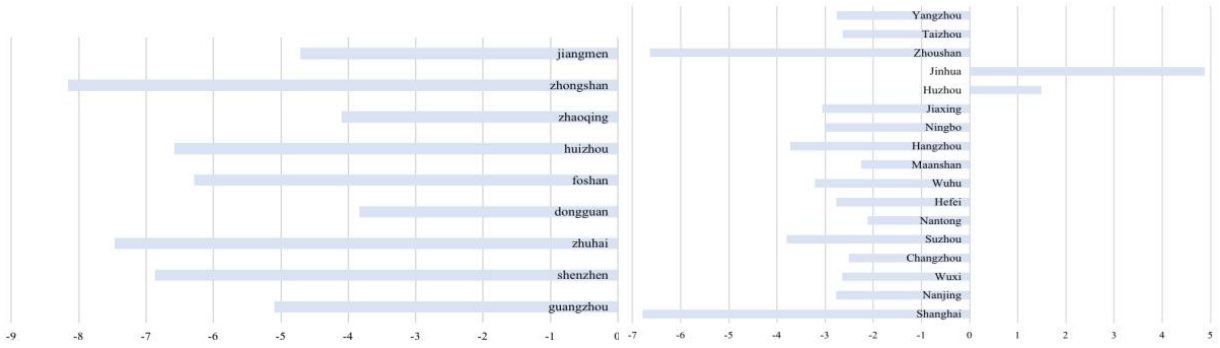


**Figure 7**. PRD and YRD's tourism resilience at the production level during COVID-19.

Shenzhen in the PRD confronted elevated risks of disease outbreaks due to their substantial populations and substantial passenger flows. Furthermore, these cities possessed a robust tertiary sector, resulting in considerable repercussions on the tourism industry due to the impeded conduct of business-related travel, conferences, and related activities. Consequently, tourism resilience tended to be relatively feeble in the unchanged scenario. Similarly, cities like Zhoushan in the YRD and Zhuhai in the PRD, where tourism constitutes a pivotal economic pillar, faced a stark reduction in tourist numbers during the pandemic. These cities grappled with pronounced negative impacts, as the pandemic's effects lingered within a condensed timeframe, consequently leading to subpar tourism resilience.

Satellite cities of major metropolises demonstrated relatively high tourism resilience. Cities in proximity to major urban centers, such as Jinhua and Huzhou in the YRD, and Huizhou and Jiangmen in the PRD, exhibited commendable tourism resilience. This trend was chiefly attributed to pandemic-induced constraints on long-distance population movements, which stimulated demand for tourism in the vicinity of larger urban hubs.

Internally within both regions, disparities in tourism resilience among some cities, which are the traditional industrial centers or emerging manufacturing hubs, remained indistinct, characterized by a generally weak state of resilience. The pandemic's impact on the tourism sector did not manifest conspicuous differences across these two city typologies.

In summary, the COVID-19 pandemic underscored an overarching deficiency in tourism resilience across the YRD and the PRD. The two regions exhibited analogous patterns, with minimal differentiation in tourism resilience among the cities within each respective region.

## 4.3 Comparison of tourism resilience at the consumption level in the two regions

### *During financial crisis*

As depicted in **Figure 8**, the research findings are in concordance with previously employed production-oriented indicators of resilience, indicating a consistent outcome. Regardless of whether measured by tourist visitation or tourism revenue, the resilience of the Pearl River Delta's tourism sector appeared notably inferior in comparison to that of the Yangtze River Delta. On one hand, the financial crisis had a more extensive impact on the Pearl River Delta. In terms of tourist visitation, represented by the number of tourists, nearly half of the cities within the Pearl River Delta exhibited negative R-values. This disparity becomes even more pronounced when considering the indicator of tourism revenue, as only one city, Jiangmen, displayed a positive R-value. In contrast, within the Yangtze River Delta, the scope of cities with negative R-values for both tourist numbers and tourism revenue indicators was significantly lower compared to the Pearl River Delta, indicating a relatively stronger tourism resilience in the Yangtze River Delta.

On the other hand, the Pearl River Delta exhibited a more pronounced fluctuation in its R-values, with a

distinct and significantly negative profile of tourism resilience. In terms of tourist numbers, Zhuhai and Shenzhen within the Pearl River Delta exhibited notably low R-values of approximately –0.7 and –0.62, respectively, while the highest R-value observed in Jiangmen was only approximately 1.05. Within the cities of the Yangtze River Delta, however, the lowest R-value was approximately –0.26, while the highest reached around 0.78, thus depicting a comparatively narrower range of fluctuations. Furthermore, when considering the indicator of tourism revenue, the lowest R-value among the cities within the Pearl River Delta was approximately –0.66, whereas the corresponding figure for the Yangtze River Delta was about –0.42, providing further emphasis on the lower resilience observed in the Pearl River Delta.

Nevertheless, it is noteworthy that both regions exhibited disparities in their internal structures. In the case of the Pearl River Delta, the eastern regions generally displayed weaker relative tourism resilience at the consumption level compared to the western regions, irrespective of whether assessed by tourist numbers or tourism revenue. In the Yangtze River Delta, on the other hand, the northern regions demonstrated relatively lower tourism resilience in terms of tourist numbers, whereas in terms of tourism revenue, the southern regions manifested generally weaker relative resilience.

### *During COVID-19*

As depicted in **Figure 9**, in stark contrast to the resilience measurements at the production level, the impact of the COVID-19 pandemic yielded distinct regional differentiations in tourism resilience within the Yangtze River Delta and the Pearl River Delta at the consumption level. Moreover, these outcomes stood in complete opposition to the results observed during the financial crisis.

During the COVID-19 pandemic, the western regions of the Pearl River Delta consistently displayed lower levels of relative tourism resilience at the consumption level compared to the eastern regions. This phenomenon was entirely divergent from the findings during the financial crisis, wherein the eastern regions of the Pearl River Delta exhibited comparatively inferior relative resilience. Turning to the

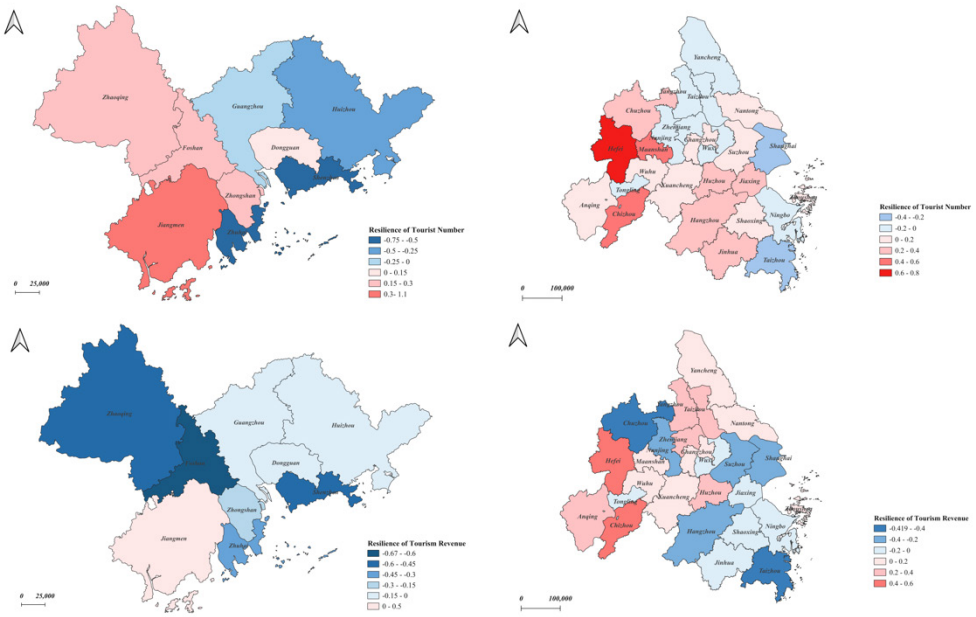


**Figure 8**. PRD and YRD's tourism resilience at the consumption level during the financial crisis.

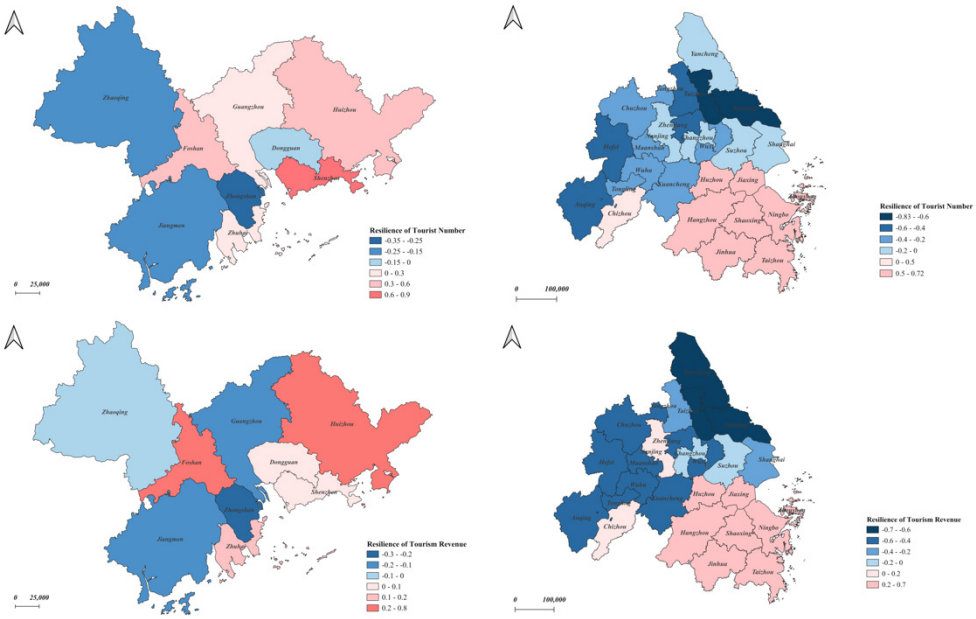


**Figure 9**. PRD and YRD's tourism resilience at the consumption level during COVID-19.

Yangtze River Delta, regardless of whether measured by tourist numbers or tourism revenue, the relative resilience within the northern regions of the Yangtze River Delta significantly lagged behind that of the southern regions, again in complete contrast to the performance during the financial crisis.

This study discerns a consistent pattern amidst notable variations in responses to distinct crises within the two regions. Specifically, in economically advanced locales, their tourism resilience tends to exhibit weaker performance during financial crises while displaying stronger performance during public crises. The eastern region of the Pearl River Delta is more economically advanced than its western counterpart, encompassing cities such as Guangzhou, Shenzhen, and Dongguan. Among these, Guangzhou serves not only as the provincial capital of Guangdong province, but also as a pivotal commercial, trade and industrial hub in South China, boasting advanced sectors in automobile production and electronic manufacturing industries. Shenzhen holds the status of a mega-city and international metropolis in China, featuring a well-developed sector of electronic information and communication equipment manufacturing. Similarly, Dongguan possesses a solid manufacturing foundation and has nurtured clusters of electronic industries. As for the Yangtze River Delta, its southern region covers a range of provincial capitals, first-tier megacities, and emerging cities such as Shanghai, Nanjing, Hangzhou, Suzhou, and Changzhou. These areas are characterized by their robust industrial foundation and notable levels of economic development. It is observed that both the eastern region of the Pearl River Delta and the southern region of the Yangtze River Delta exhibited weaker relative tourism resilience during financial crises, whereas they demonstrated notable resilience during the COVID-19 pandemic.

This distinction can be attributed to the varying scopes of the impact that different crises have on industries, as well as the differentiation in residents' income and demand levels among regions of different economic levels. In the case of economic crises, the repercussions often span across various industries and tend to result in pronounced market fluctuations, thereby detrimentally affecting the real economy. This process is often accompanied by a surge in business closures, leading to an escalation in unemployment rates and a reduction in residents' income and purchasing power. This directly contributes to a rapid contraction in consumption within the leisure and tourism sector. Therefore, during economic

crises, economically advanced regions tend to exhibit poorer relative tourism resilience. Conversely, during public crises, the extent of damage to the real economy is generally lower than that seen during economic crises. Economically advanced regions still maintain robust economic capabilities, with generally higher social incomes and greater consumer capacity compared to less developed regions. Even under pandemic control measures and transportation restrictions, residents in these advanced regions still have a demand for leisure travel and the purchasing power to support it. Thus, in comparison to less developed urban areas, the tourism industries in these advanced regions exhibit greater resilience in the face of public crises, attributed to their stronger capacity to withstand and adapt to such circumstances.

## 5. Conclusions and discussion

This study undertakes an evaluation and comparative analysis of the tourism resilience performance of the Pearl River Delta and the Yangtze River Delta under different crises. It derives the following three main conclusions.

Firstly, regions with higher levels of economic development tend to exhibit relatively weaker tourism resilience in the face of economic crises, while showcasing relatively stronger resilience during public crises. This pattern is evident in both the eastern region of the Pearl River Delta and the southern region of the Yangtze River Delta, both of which are characterized by their greater economic development. During the financial crisis period, these regions manifested a notable fragility in terms of relative tourism resilience. However, during the COVID-19 pandemic, their tourism resilience demonstrated a more robust performance. This observation is intrinsically linked to variations in the scope of impact that different crises have on industries, as well as differences in the income levels and leisure demands of residents in regions with varying economic statuses.

Secondly, in a broad sense, there are discernible disparities, both inter-regionally and intra-regionally, within the Yangtze River Delta and the Pearl River Delta. The overall tourism resilience of the Yangtze River Delta surpassed that of the Pearl River Delta, and this characteristic was more pronounced during the financial crisis period. Moreover, at the intra-regional urban scale, during the financial crisis, the western region of the Pearl River Delta's tourism resilience outperformed its eastern counterpart, while within the Yangtze River Delta, the tourism resilience of the northern region slightly exceeded that of the southern region. However, during the COVID-19 pandemic, the tourism resilience of the eastern coastal area of the Pearl River Delta surpassed that of the western coastal area, while within the Yangtze River Delta, the tourism resilience of the southern region notably outperformed that of the northern region. These variations predominantly stem from variations in geographical positioning, tourism resource endowments, industrial and economic structures, as well as economic development paths, both regionally and within individual cities.

Thirdly, when assessing the resilience of regional tourism industries, a singular dimension is insufficient for measurement; instead, a multi-dimensional perspective should be employed to more comprehensively capture the essence of tourism resilience. As an industry where production and consumption occur concurrently, the tourism industry necessitates an evaluation that encompasses both production and consumption dimensions to adequately gauge its resilience. This study reveals that when utilizing indicators from these dual dimensions to measure regional tourism resilience, there is a relatively consistent outcome during financial crises. However, there is substantial divergence in results during the COVID-19 pandemic: In comparison to the production-oriented indicators, employing consumption-oriented indicators to measure regional tourism resilience yields more pronounced regional differentiations. Consequently, the adoption of multi-dimensional indicators is imperative for characterizing and dissecting regional tourism resilience accurately, enabling a precise understanding of the process and impact of crisis shocks.

The comparative analysis of the tourism resilience between the Yangtze River Delta and the Pearl River

Delta in this study is based on grasping the absolute resilience of the two regions, and then analyzing intraregional disparities. This approach helps to better grasp the development characteristics of the region and provides a potential perspective for addressing the challenge of comparing relative resilience. In practice, this study adopts a multi-dimensional method to elucidate the essence of regional tourism resilience under various crises, thereby offering valuable insights for local governments when formulating relevant tourism policies. For example, in the event of a crisis, it is necessary to judge whether the crisis has affected the foundational aspects of the tourism industry and to pay close attention to employment and consumption support within the tourism industry. Overall, the method adopted in this study allows for a nuanced understanding of how and to what extent different types of crises affect the tourism sector, which plays a positive role in advancing the research on regional tourism resilience.

This study believes that future research should focus on further enhancing resilience, delving deeper into the comprehensive characterization of the evolution of regional tourism resilience, and providing further elucidation on the causal relationship between multi-dimensional indicators and the disparities in the impact of multiple external factors on regional tourism resilience.

## Author Contributions

Yi Liu: Conceptualization, Methodology, Case analysis, Resources, Investigation, Writing—Original Draft, Writing—Review & Editing, Funding acquisition.

Liaofan Chen: Methodology, Case analysis, Investigation, Data Curation, Writing—Original Draft, Writing—Review & Editing.

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## Conflict of Interest

There is no conflict of interest.

## Data Availability Statement

The data generated during and/or analyzed during this study "Regional Tourism Resilience Under Crisis Impacts: the cases of Yangtze River Delta and Pearl River Delta" are available from the corresponding author on reasonable request.

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