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Exploring the Dynamic Cultural Driving Factors Underlying the Regional Spatial Pattern of Chinese Traditional Villages

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Abstract: In the context of global urbanization, traditional villages have garnered increasing scholarly interest due to their role in preserving rich ethnic cultures and their potential contributions to cultural heritage. Existing literature has predominantly attributed the spatial heterogeneity of traditional villages to natural, environmental, and economic factors. However, cultural elements, which are equally crucial to the inheritance and continuation of traditional villages, are rather deficient in current research. By establishing a tripartite framework encompassing "natural environment—space economy—social culture" elements, this article first employs relevant geographic spatial analysis to examine the overall distribution patterns of Chinese traditional villages. Subsequently, it utilizes the Optimal Parameter-based GeoDetector model to assess the maximum impact of single factors and interactions among factors on the spatial heterogeneity of Chinese traditional villages. The paper then integrates spatial production theory to reveal the mechanisms underlying the interactions among these tripartite elements. The research findings indicate that cultural factors exert the most substantial influence on the spatial distribution of traditional Chinese villages, in contrast to previous research records that suggested natural elements had the greatest impact. Additionally, population and genealogy emerge as the two most critical factors, with their interaction having the most significant effect on the spatial pattern of Chinese traditional villages ($q = 0.82663$). Finally, we put forward regional-level recommendations for the preservation of traditional villages. Overall, our work can not only provide valuable insights for global research on traditional villages in developing countries based on traditional agriculture but also offer recommendations for the preservation of traditional villages in China.

Keywords: Chinese traditional villages; ArcGIS; spatial heterogeneity; spatial pattern; Optimal Parameter-based GeoDetector

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1. Introduction

Traditional villages have high historical, cultural, aesthetic, and economic values. They are the breeding ground and inheritance place of national culture, which not only carries the historical memory of a specific period and region but also is the genetic heritage of human culture. In this sense, they offer essential leads to excavate the historical and cultural richness of various times and regions [1–3]. However, based on the number of Chinese villages promulgated by the National Bureau of Statistics of China, there were 3.773 million in 1990 and 2.633 million at the end of 2021, a decrease of 1.14 million in 31 years, with an average of 101 disappearing every day. In addition, relevant studies have shown that the hollowness index of TVs has exceeded 0.5 [4]. As the global urbanization process continues to advance, many countries are witnessing a significant influx of rural populations into urban areas, accompanied by the encroachment of cities into rural regions [5,6]. This phenomenon accelerates the decline of rural areas and may lead to issues such as environmental pollution and a shortage of rural development momentum [7,8]. These challenges significantly impede the sustainable development of rural civilizations. Therefore, a quantitative analysis of the spatial heterogeneous patterns of TVs and their underlying causes holds crucial significance at a macro level for advancing the protection, development, and cultural heritage of TVs.

Since the 1840s, when German geographer J. G. Kohl studied settlement types and their development patterns, scholars worldwide have studied human settlements without interruption [9]. Especially in recent years, studying TVs has been an academic hotspot in settlement research [10–12]. In order to achieve the sustainable development of TVs, previous literature with relevant research on TVs from multiple perspectives. These perspectives encompass individual villages, including aspects such as ancient dwellings [13], spatial morphology [2], rural landscapes [14], spatial patterns [15], microclimate environments [16], etc. They also extend to village clusters, encompassing topics such as the evolutionary patterns of rural settlements [17], spatial distribution characteristics [18], and their influencing factors [19]. In summary, the above-mentioned studies offer valuable insights for formulating development and preservation policies for traditional villages at various levels. It is important to note that a comprehensive and systematic investigation is needed to better understand the spatial heterogeneity characteristics of traditional villages and their underlying causes, particularly by enhancing the consideration of cultural factors.

Currently, there are various research methods for studying the spatial heterogeneity of large-scale TVs, which can be broadly categorized into two main types. The first type focuses on the geographical distribution differences in TVs. Commonly used methods include kernel density analysis [20], hotspot analysis [21], concentration degree [22], standard deviational ellipses [23], and global Moran's index. Some studies also employ economic methods, such as the Gini coefficient and Lorenz curves [24]. The second type explores the correlation of influencing factors related to the spatial heterogeneity of TVs. Methods used for this purpose include the Pearson correlation coefficient [18], logistic regression [17], multiscale geographically weighted regression [25], and GeoDetector [26]. However, there are still limitations in the current research regarding the assessment of the maximum impact of individual influencing factors and the interaction of these factors in spatial heterogeneity.

Moreover, the selection of influencing factors for the spatial heterogeneity of TVs is equally crucial. Current research indicators mainly encompass both natural and economic aspects. For example, Gao and his colleagues investigated how elements such as topography, hydrology, urbanization, transportation, and economics influence the spatial distribution of TVs in the Yellow River Basin [27]. Some scholars also consider additional factors like population and climate [18,28]. It is worth noting that the formation of rural settlements is closely related not only to the natural environment and economics but also to culture [29,30]. While some studies have touched upon cultural factors such as intangible cultural heritage and the cultural industry [18], these aspects remain underexplored. This limitation restricts the multidimensional analysis of spatial heterogeneity in TVs and hinders the provision of a scientific basis for regional rural planning.

To address the aforementioned research gaps, this study constructs a "natural environment (NE)—space economy (SE)—social culture (SC)" tripartite analytical framework. By employing the Optimal Parameter-based GeoDetector (OPbGD), it achieves the optimal detection of the influences of natural environmental factors, spatial economic factors, and socio-cultural factors on the spatial heterogeneity of Chinese traditional villages (CTVs). Furthermore, it combines spatial production theory to unveil the mechanisms of interaction between these influencing factors, thereby providing scientific guidance for the overall planning of CTVs and the protection of cultural heritage. Abbreviations in this article are shown in Figure 1.

Nomenclature

CTVs	Chinese Traditional Villages
TVs	Traditional Villages
NE	Natural environment
SC	Social culture
SE	Space economy
ELE	Elevation
RE	Relief
CZ	Climate zones
DW	Distance from the water system
LCT	Land cover types
LDF	Landforms
DoNICH	Density of National Intangible Cultural Heritages
DoNICHI	Density of National Intangible Cultural Heritage Inheritors
DoNCPU	Density of National Cultural Protection Units
NoM	Number of Minorities
NoG	Number of Genealogies
LZ	Language Zones
DoNATA	Density of National A-class Tourist Attractions
DoNPoA	Density of National Parks of China
POP	Population
GDP	GDP per capita
TP	Tertiary sector people
NoLSE	Number of large-scale enterprises
TRA	Transportation
URB	Urbanization
OPbGD	Optimal Parameter-based GeoDetector

Figure 1. Nomenclature.

2. Materials and Methods

2.1. Study Area

The study area is shown in Figure 2. China has a large landmass, abundant natural resources, and diverse landscapes. It divides into two main segments, separated by the Hu Huanyong Line, which acts as a geographic barrier. While the northwest is high yet has a complicated environment and a limited population, the southeast is low and relatively flat and has a large population and a sophisticated economy. China also contains 56 distinct ethnic groups, each with a rich cultural past and material legacy, and numerous historic villages that retain ethnic features. As of April 2023, the Ministry of Housing and Urban-Rural Development of China has released six batches of TVs, comprising 8155 villages. The promotion of cultural diversity is a vital driving force for development, not just in terms of economic advancement but also in terms of enhancing individuals' intellectual, emotional, moral, and spiritual well-being [31,32]. Therefore, understanding the spatial pattern and driving elements of CTVs is crucial to the development of cultural diversity in the world.

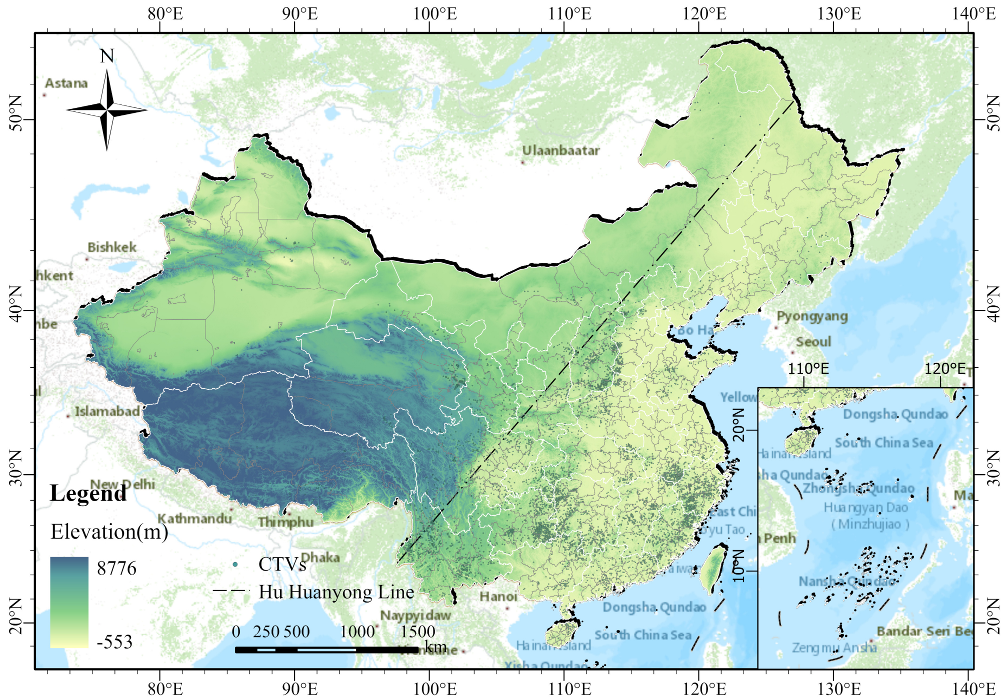

Figure 2. Study area. The satellite imagery was sourced from the Geospatial Data Cloud (https://www.gscloud.cn/search (accessed on 5 December 2023)), and the administrative boundaries were obtained from the Chinese Ministry of Natural Resources standard map website (http://bzdt.ch.mnr.gov.cn/ (accessed on 5 December 2023)). The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

2.2. Data Sources

The sample data in this study include data from three aspects: the natural environment, the spatial economy, and the social culture. The specific data sources are listed in Table 1. These data samples have two main advantages. First, they exhibit diversity in categorical attributes, encompassing aspects of the natural environment such as topography, climate, landforms, land types, and water systems, as well as spatial economic aspects including per capita GDP, the number of tertiary sector employees, the number of large-scale enterprises, government locations, roads, etc. Additionally, they include cultural aspects such as cultural heritage, ethnic minorities, genealogy, language, and scenic areas, among others. The other advantage is the extensive coverage, which can highlight nationwide variations and distinctive characteristics. Furthermore, the diversity of the sample data can be instrumental in comparing variations in the interaction of driving factors.

Table 1. Summary of data sources.

Type		Application	Source	Resolution
Natural Environment (NE)	DEM	Elevation (ELE), Relief (RE)	Geospatial Data Cloud (https://www.gscloud.cn/search (accessed on 5 December 2023))	30 m
	Climate Zones, Land cover types, Landforms	Climate Zones (CZs), Land cover types (LCTs), Landforms (LDFs)	Resource Environment and Data Center of the Chinese Academy of Sciences (https://www.resdc.cn/data.aspx?DATAID=124 (accessed on 5 December 2023))	/(No resolution)
	Water system	Distance from the water (DW)	OpenStreetMap (http://www.openstreetmap.org/ (accessed on 5 December 2023))	/

Table 1. *Cont.*

Type		Application	Source	Resolution
Space Economy (SE)	Population	Population (POP)	Bulletin of the Seventh National Census	/
	GDP per capita, Tertiary sector people, Number of large-scale enterprises	GDP per capita (GDP), Tertiary sector people (TP), Number of large-scale enterprises (NoLSE)	China City Statistical Yearbook (2020)	/
	City government location	Urbanization (URB)	Baidu map (https://map.baidu.com/@12576415,3251499,13z (accessed on 5 December 2023))	/
	Roads	Transportation (TRA)	OpenStreetMap (http://www.openstreetmap.org/ (accessed on 5 December 2023))	/
Social Culture (SC)	Cultural heritage	Density of National Intangible Cultural Heritages (DoNICHs), Density of National Intangible Cultural Heritage Inheritors (DoNICHIs), Density of National Cultural Protection Units (DoNCPUs)	China Intangible Cultural Heritage Network (https://www.ihchina.cn/ (accessed on 5 December 2023))	/
	Minorities	Number of Minorities (NoM)	The 7th China Population Census	/
	Genealogies	Number of Genealogies (NoG)	General Catalogue of Chinese Genealogy	/
	Language	Language Zones (LZs)	Atlas of Chinese Languages	/
	Scenic areas	Density of National A-Class Tourist Attractions (DoNATAs), Density of National Parks of China (DoNPoA)	Chinese Ministry of Culture and Tourism (https://www.mct.gov.cn/ (accessed on 5 December 2023))	/

2.3. Methods

This study consisted of four sequential steps, as depicted in Figure 3. The initial step involved data collection and processing. Subsequently, an in-depth analysis and statistical investigation were conducted to examine the spatial patterns of CTVs and their associated driving factors. In the third step, the OPbGD model was employed to carry out the optimal discretization classification of each factor, enabling an accurate evaluation of the influence levels of both individual and interactive effects on the spatial differentiation of CTVs. Lastly, based on the analysis findings, the study delved into the mechanisms underlying the interactions among different influencing factors and provided relevant conservation recommendations for preserving CTVs.

In general, this study investigates the spatial pattern of CTVs by establishing a three-party analytical framework and examining it from the perspectives of the natural environment, space economy, and social and cultural factors. It not only expands the examination of cultural factors, achieving optimal detection under single and dual-factor influences, but also reveals the spatial distribution patterns of CTVs. Furthermore, by integrating spatial production theory, it delves into the mechanisms underlying the formation of spatial patterns in CTVs. This research is expected to provide policy guidance for the protection and development of regional living environments.

2.3.1. Spatial Pattern Analysis Methods

The geospatial analysis methods used in this study are shown in Table 2.

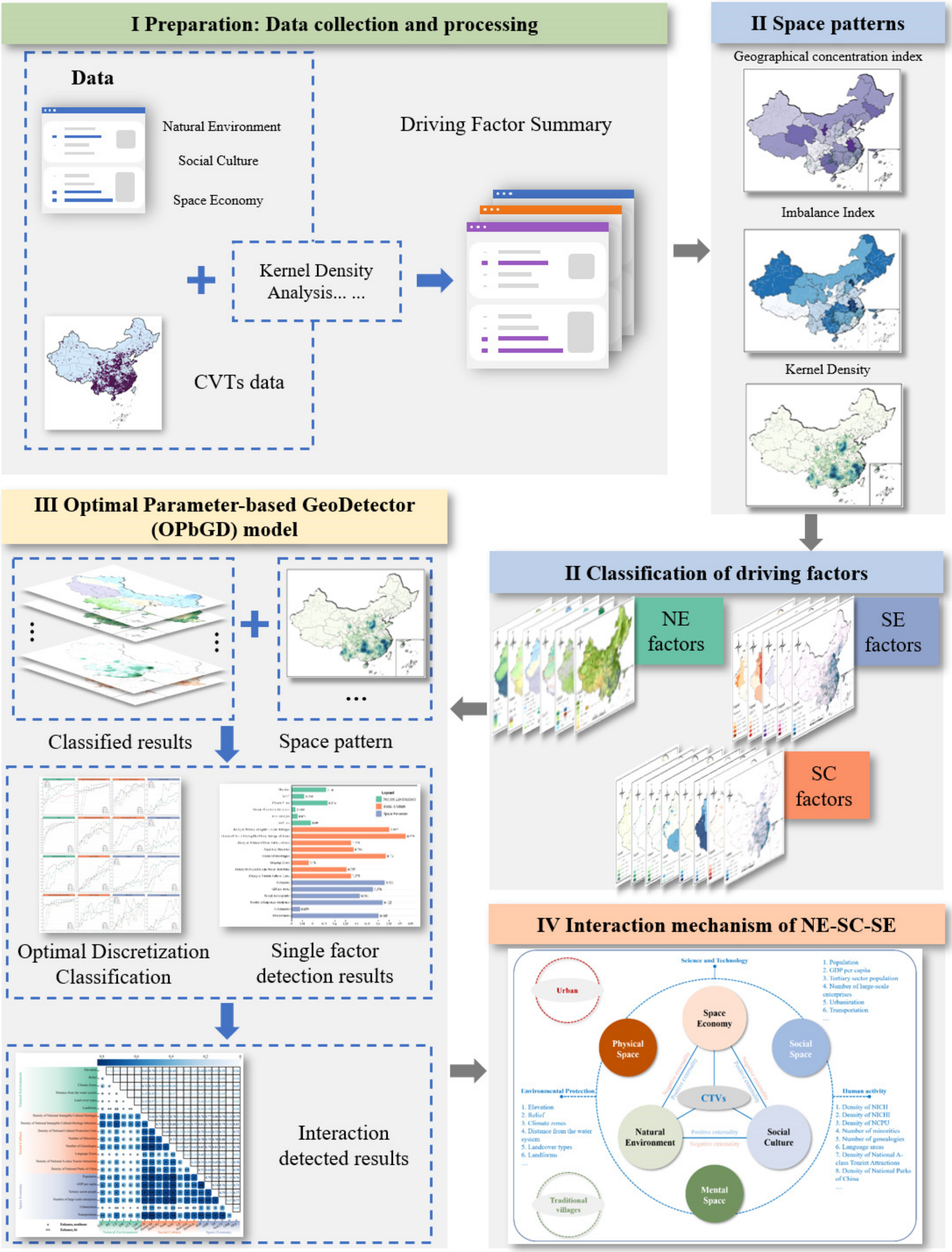

Figure 3. Research Framework.

Table 2. Geospatial analysis methods.

Methods	Formulas	Definition	Description	Number
Multi-distance spatial cluster analysis	$M(\mathrm{d}) = \sqrt{\frac{C\sum_{a=1}^{m}\sum_{b=1,a\neq b}^{m} k_{a,b}}{\pi m(m-1)}}$	where m is the number of TVs in the study area, d is the distance, and C is the area of the study area. $k_{a,b}$ is the weight.	The TVs exhibit a clustered distribution if $M(\mathrm{d})$ is greater than 0, while $M(\mathrm{d})$ less than 0 suggests a dispersed distribution.	(1)
Geographical Concentration Index (GCI)	$g = 100 \times \sqrt{\sum_{a=1}^{n}\left\{\frac{X_a}{B}\right\}^2}$	where g is the GCI of the TVs, X_a is the number of TVs in the a-th city-level administrative district, B represents the total number of TVs, and n is the total number of prefecture-level cities.	The value of g ranges from 0 to 100, with higher values indicating a more concentrated configuration of TVs and lower values indicating a more dispersed configuration.	(2)
Imbalance index (IMI)	$S = \frac{\sum_{i=1}^{n} R_i - 50(x+1)}{100x - 50(x+1)}$	x stands for the total number of prefecture-level cities within the research area, and R_i represents the accumulated percentage of the ranking of the ratio of TVs in each prefecture-level city to all TVs in the area, from the largest to the smallest, at the i-th position.	The value of S is between 0 and 1. When $S = 0$, TVs are evenly distributed across all prefecture-level cities; when $S = 1$, all TVs are concentrated in one city.	(3)
Kernel density (KDE) analysis	$\mathrm{E}(z) = \frac{1}{md}\sum_{a=1}^{m} k\left(\frac{z - z_a}{d}\right)$	$\mathrm{E}(z)$ is the KDE estimate, with d as the search bandwidth. Additionally, m represents the count of point elements, $(z - z_a)$ denotes the distance from the estimated point z to z_a, and $k\left(\frac{z-z_a}{d}\right)$ is the kernel function.	A higher value of $\mathrm{E}(z)$ indicates a greater level of clustering, while conversely, a lower value indicates a sparser distribution of points.	(4)
Moran's I	$I = \frac{m\sum_{a=1}^{m}\sum_{b=1}^{m} W_{ab}(x_a - \overline{x})(x_b - \overline{x})}{\sum_{a=1}^{m}\sum_{b=1}^{m} W_{ab}\sum_{a=1}^{m}(x_a - \overline{x})^2}$	where x_a and x_b are the counts of the point features in regions a and b, respectively; $\overline{x}$ is the mean value of $x_1, x_2, \ldots, x_m$; W_{ab} represents the spatial weights matrix; and m refers to the count of spatial cells.	The Moran's I statistic ranges from −1 to 1. If $I > 0$, it demonstrates the presence of positive space autocorrelation, whereas $I < 0$ shows the presence of negative space autocorrelation. If $I = 0$, it demonstrates the absence of space autocorrelation.	(5)
Getis-Ord Gi*	$Gi* = \frac{\sum_{b=1}^{n} w_{a,b}x_b - \overline{x}\sum_{b=1}^{n} w_{a,b}}{m_s\sqrt{\frac{\left[n\sum_{b=1}^{n} w_{a,b}^2 - \left(\sum_{b=1}^{n} w_{a,b}\right)^2\right]}{n-1}}}$	x_b is the attribute value of feature b, $w_{a,b}$ is the spatial weight between feature a and feature b, n is the total count of features, $\overline{x}$ is the mean value, and m_s is the standard deviation of x_b.	Higher z-scores indicate the presence of significant spatial clustering of high attribute values, often referred to as hot spots. In comparison, lower z-scores indicate the presence of significant spatial clustering of low attribute values, often referred to as cold spots.	(6)

2.3.2. Optimal Parameter-Based GeoDetector

GeoDetector is a commonly used model to recognize spatial heterogeneity and its related forces [33,34]. However, the Optimal Parameter-based GeoDetector can improve upon the standard GeoDetector by implementing optimal discrete classification of sample data, including methods such as natural break classification, quantile classification, and geometric interval classification, to detect the maximum q-value of driving factors as well as the maximum q-value of their interactions [35]. Furthermore, this model does not require the assumption of collinearity and is applicable to both continuous and categorical variables [36]. Calculations can be conducted using the GD package in the R language (https://cran.r-project.org/web/packages/GD/vignettes/GD.html (accessed on 5 December 2023)).

3. Distribution Characteristics of CTVs

3.1. Spatial Pattern and Degree of Concentration

The findings of the distance-based spatial clustering analysis for CTVs are presented in Figure 4. The analysis reveals that the observed values of TVs consistently surpass the upper boundary of the confidence interval within the range of iterative distances. This suggests that CTVs are distributed in a clustered manner.

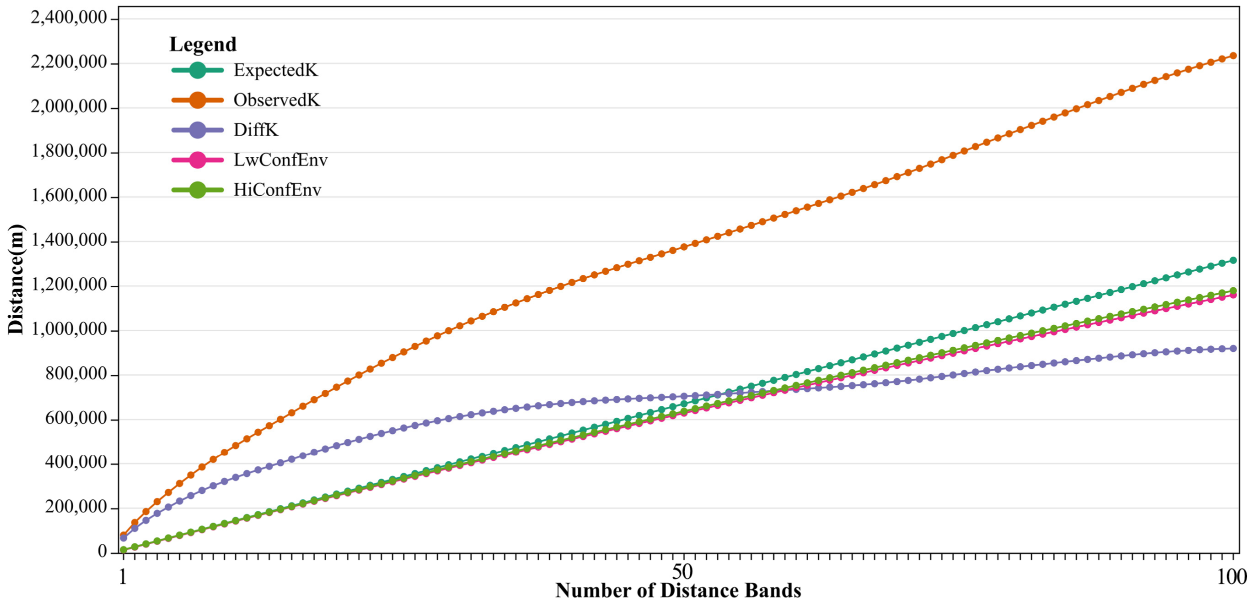

Figure 4. Multi-distance spatial cluster analysis of CTVs.

The GCI and IMI are employed to quantify the degree of concentration of point-like features distributed within different regions [37,38]. The GMI and IMI of the provinces of China are shown in Figure 5. Among the regions studied, Tianjin had the highest GCI and IMI, which were 77.06 and 0.95, respectively, indicating that the TVs in Tianjin were highly concentrated but also the most unbalanced. In contrast, Henan had the lowest GCI but an IMI of 0.52, suggesting that the TVs in Henan were less concentrated and more balanced. In contrast to Henan, Tianjin, a municipality with direct jurisdiction, experiences rapid urbanization, leading to a significant reduction in rural areas and an imbalanced distribution, resulting in a high IMI. Overall, the spatial configuration of TVs in each region was relatively concentrated but unevenly distributed.

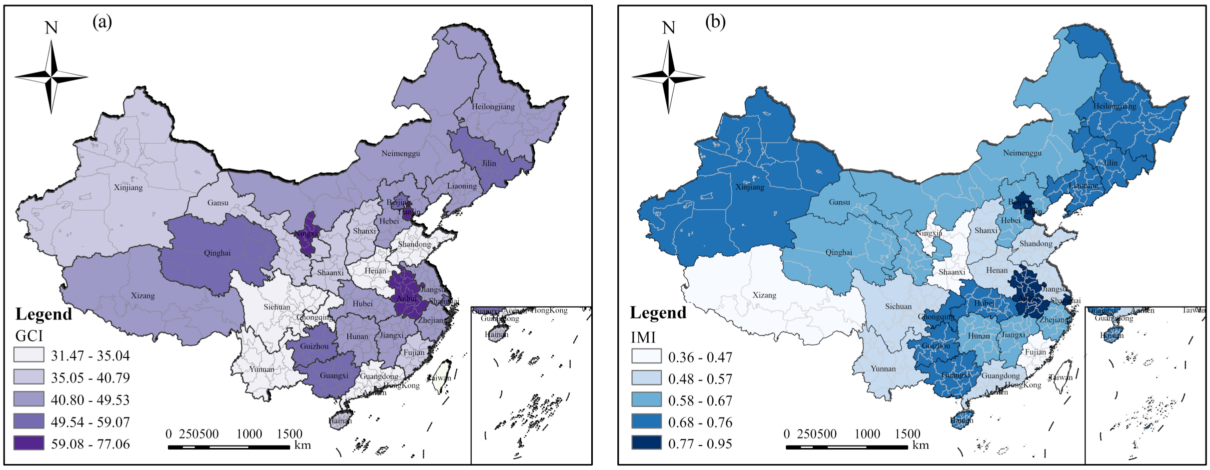

Figure 5. Concentration of CTVs. (**a**) GCI. (**b**) IMI. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

3.2. Spatial Distribution Density

Figure 6 shows the results of the KDE analysis. The findings are consistent with the high population concentration in the southeastern region and the low population in the northwestern region, demarcated by the Hu Huanyong Line. Typically, most TVs are situated on the southeast side of this line. The spatial configuration of CTVs typically demonstrates the features of "three major centers and two secondary centers". These three primary centers are located at the junction of the borders of "Shaanxi-Henan-Hebei", the contiguous area of "Anhui-Zhejiang-Fujian", and the contiguous area of "Hunan-Chongqing-Guizhou-Guangxi". The two secondary centers are situated east of Qinghai and northwest of Yunnan. This shows that the spatial distribution of CTVs is closely linked not only to population but also to the natural geographical environment.

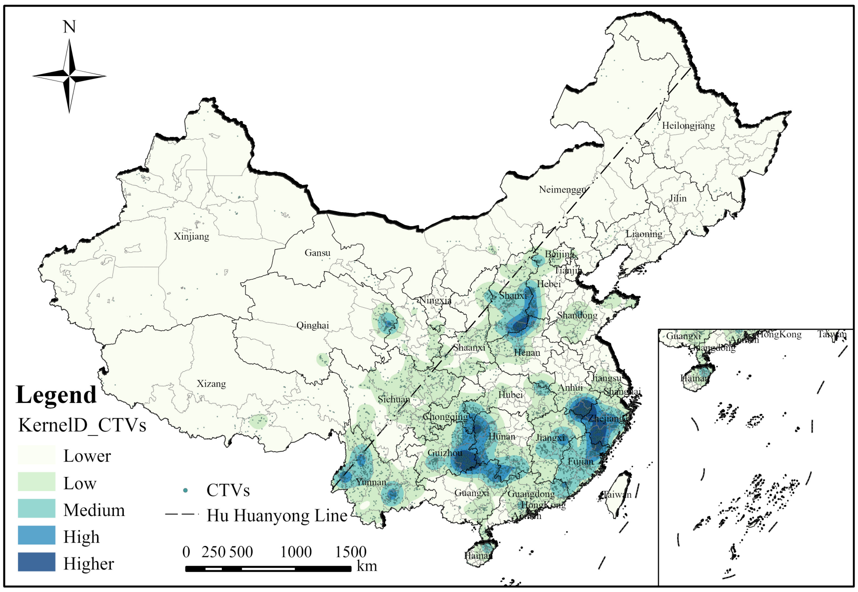

Figure 6. KDE analysis results of CTVs. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

3.3. Spatial Autocorrelation Characteristics

The spatial autocorrelation analysis was conducted on the distribution of CTVs, and the result showed a global Moran's I value of 0.31. The normal statistic z is 2.83, which exceeds the threshold value of 2.58 for the confidence level, and the *p*-value is less than 0.01, showing significant spatial autocorrelation. The clustering tendency of CTVs in space is evident.

The hotspot analysis of CTVs on multiple scales was conducted using ArcGIS, and the outcomes are depicted in Figure 7. At the provincial scale, the spatial configuration of CTVs has a more pronounced pattern of "extreme hot spot-hot spot-sub-hot spot-cold spot". The concentration of TVs exhibits a hot spot pattern in southern China, with the most prominent concentration in Guizhou, Guangzhou, and Jiangxi, followed by Yunnan, Hunan, Fujian, and Guangzhou, which indicates that TVs in this area tend to cluster in space. Moreover, on a city scale, there are four distinct hot spots: the southeastern part of Shaanxi; the border of Hunan, Hubei, Chongqing, Guizhou, and Guangxi; the border of Anhui, Zhejiang, Jiangxi, and Fujian; and the border of southwest Yunnan. These hot spots are consistent with the results of kernel density analysis, indicating that the spatial configuration of TVs in China is characterized by clustering and agglomeration.

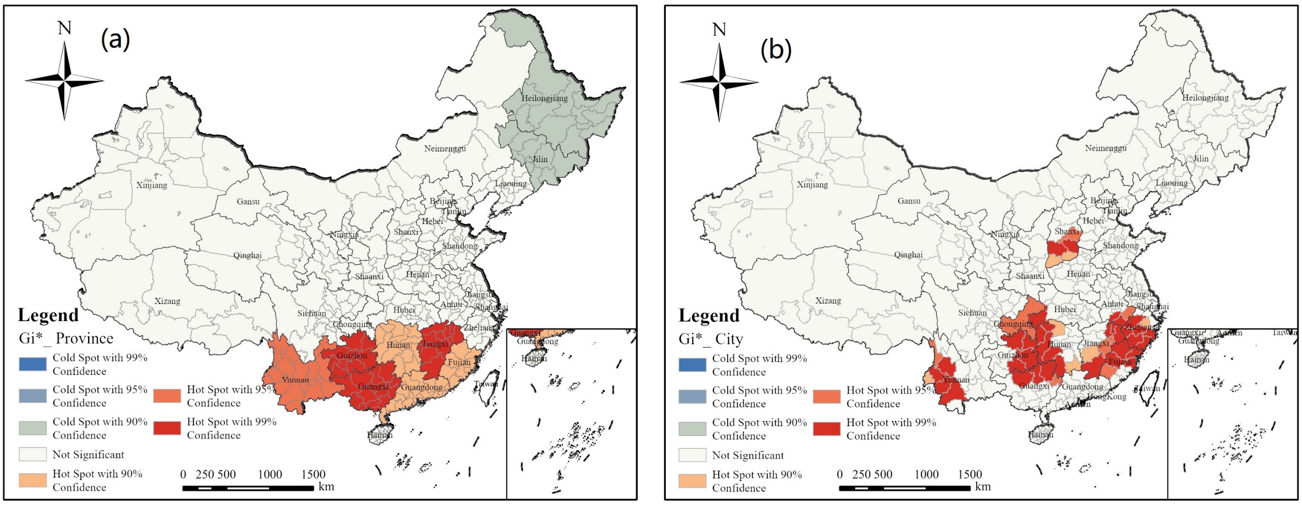

Figure 7. Provincial and city-level spatial hotspot analysis of CTVs. (**a**) Province. (**b**) City. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only. (*Gi** stands for *z*-score.)

4. Factors Influencing the Spatial Differentiation of CTVs

4.1. Natural Environment

The selection and layout of traditional settlements reflect the harmonious synergy between people, buildings, and the environment [39]. The formation of rural settlements is significantly influenced by the NE, which serves as the foundation of TVs. The topography and water system are the most prominent features of the NE in which TVs are situated. These features affect the selection of traditional village locations and have varying degrees of influence on transportation, population, culture, and other factors affecting TVs' spatial configuration.

4.1.1. Elevation and Relief

For the examination of terrain, elevation and relief are crucial quantitative markers [40]. Among them, elevation can reflect the geospatial location at the regional scale, and relief is used to describe the elevation variation in a particular area. We naturally categorize the received 30 m precision elevation data using "focal statistics" in ArcGIS and then provide a classified elevation and relief data layer. After that, it is retrieved and analyzed to determine the height and relief of TVs in China by superimposing it over the point data of those communities. Figure 8 displays the findings from the final count of TVs with various heights and reliefs.

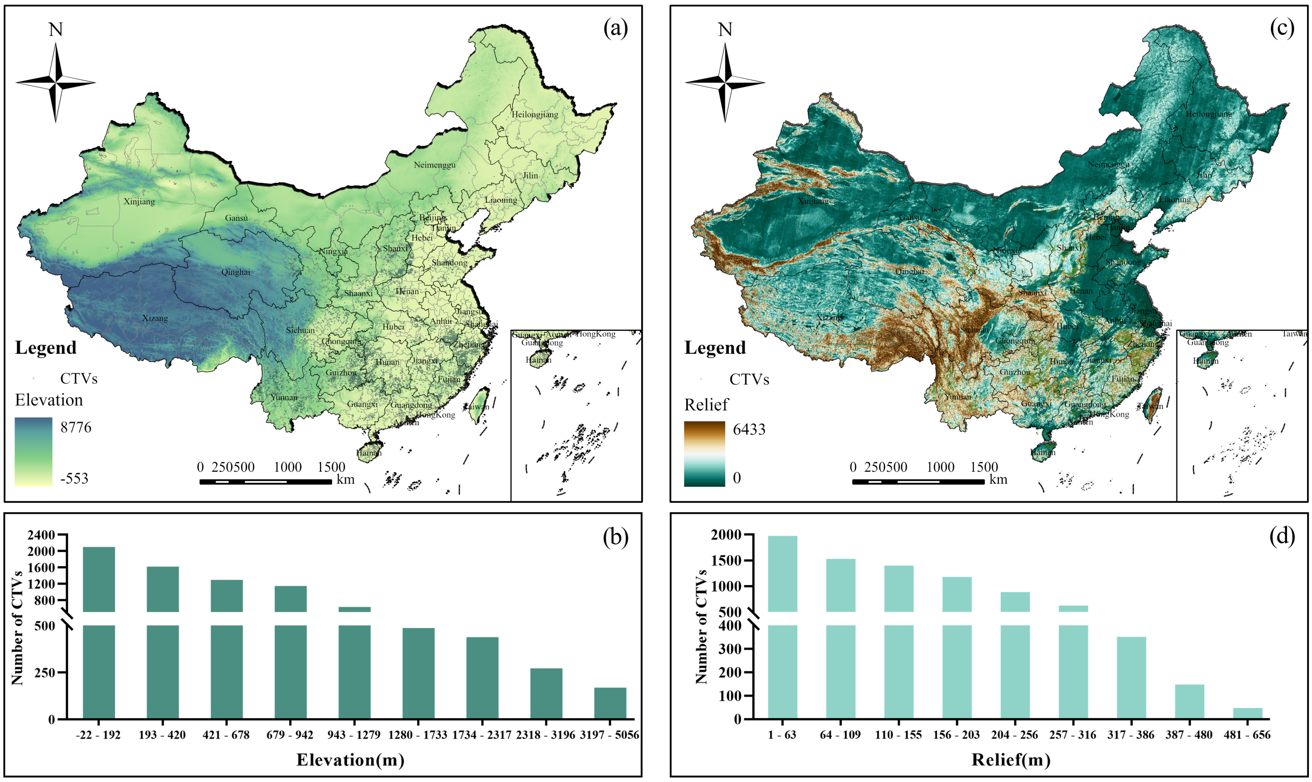

Figure 8. Analysis of the elevation and relief of CTVs. (**a**) Elevation. (**b**) Distribution of CTVs across different elevation ranges. (**c**) Relief. (**d**) Count of CTVs in each range of relief. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

Based on the statistical analysis, the TVs are most concentrated at elevations below 192 m, with 2100 villages in this range. The lowest elevation recorded was −22 m. As the elevation rises, the number becomes smaller and smaller. When the elevation exceeds 1279 m, the number of TVs drops to 630 and below; when the elevation exceeds 3197 m, there are only 169 TVs, and the highest elevation point is 5056 m. Overall, 83.2% of the TVs are below 1297 m, indicating that most are in low-elevation areas. In terms of relief, 93.2% of TVs are concentrated below 316 m, of which 1977 are below 63 m, 1530 are between 64 m and 109 m, 1402 are between 110 m and 155 m, 1180 are between 156 m and 203 m, and 889 are between 204 m and 256 m. Additionally, there are 628 villages between elevations of 257 m and 316 m, indicating that most TVs are situated within a relatively low elevation range.

4.1.2. Climate Zone and Water System

Most of the world's civilizations originated from rivers [41], and human beings primarily settled in plain areas with abundant water resources and fertile land [42]. The natural climate significantly impacts the lives and livelihoods of humans, including the location of rural settlements. The location of TVs is closely related to climate and water resources. Figure 9 displays the analysis results for the number of TVs in each climate zone. The analysis shows that the majority of TVs, comprising 49.9% of the overall amount, are concentrated in the southern subtropical climate zone, with 4068 villages. The southern temperate zone and northern tropical CZ also have a high concentration of TVs, each with over 1000 villages. After analyzing the distance between TVs and the water system, the results show that approximately 34.7% of villages are within a 5-min walk, or 0.41 km, of the water system. The number of TVs decreases as the distance from the water system increases. When the distance exceeds 4.5 km, only 429 villages comprise 5.3% of the overall amount. To summarize, the spatial arrangement of CTVs is intricately linked to the water system, with most traditional villages being scattered beside the water system.

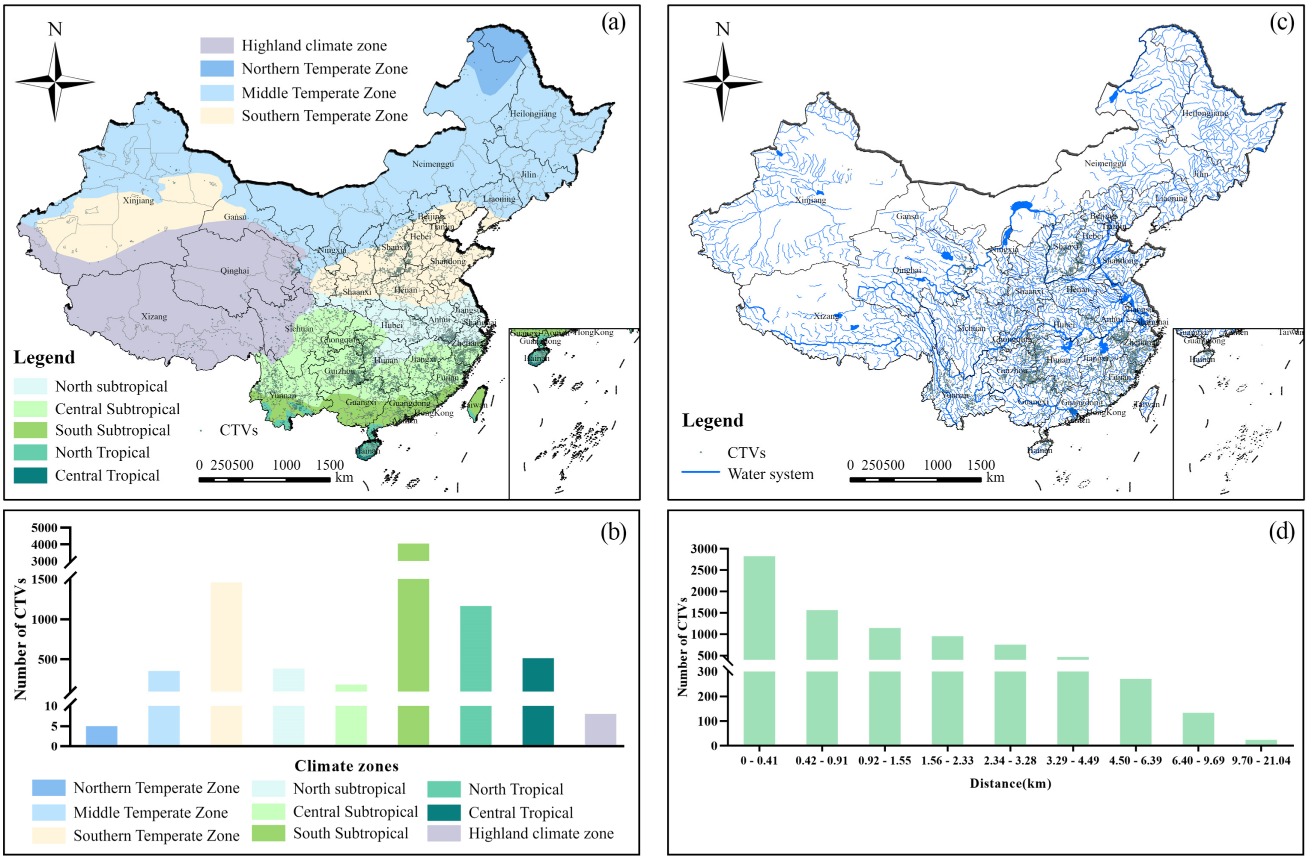

Figure 9. Analysis of the spatial configuration of CTVs in relation to CZ and water systems. (**a**) CZ. (**b**) Count of CTVs in each climate zone. (**c**) Distance from the water system. (**d**) Count of CTVs at each distance. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

4.1.3. Land Cover Types and Landforms

The spatial configuration of TVs is also related to various land types and landforms in terms of the NE. The statistical findings are presented in Figure 10. The distribution of TVs is closely related to land cover types. Most TVs are situated in cropland and artificial land cover types, followed by forest and grasslands. These land cover types provide abundant natural resources and favorable living conditions for developing TVs. In contrast, TVs are sparsely distributed in regions with extreme land cover types. Regarding landforms, the majority of TVs are located in regions with plain, small undulating hills, and medium rolling hills landforms, which account for a total of 5447 villages. Next, 1173 villages are located on the terrace; 1074 villages are in hills; 458 villages are in large rolling hills; and only three villages are in extremely undulating hills. Most TVs survive in mountainous terrain because it provides a natural barrier to the survival of TVs and protection for the inhabitants who fled from war in ancient times. In general, most TVs are located in places with access to daily life resources but are also protected by nature.

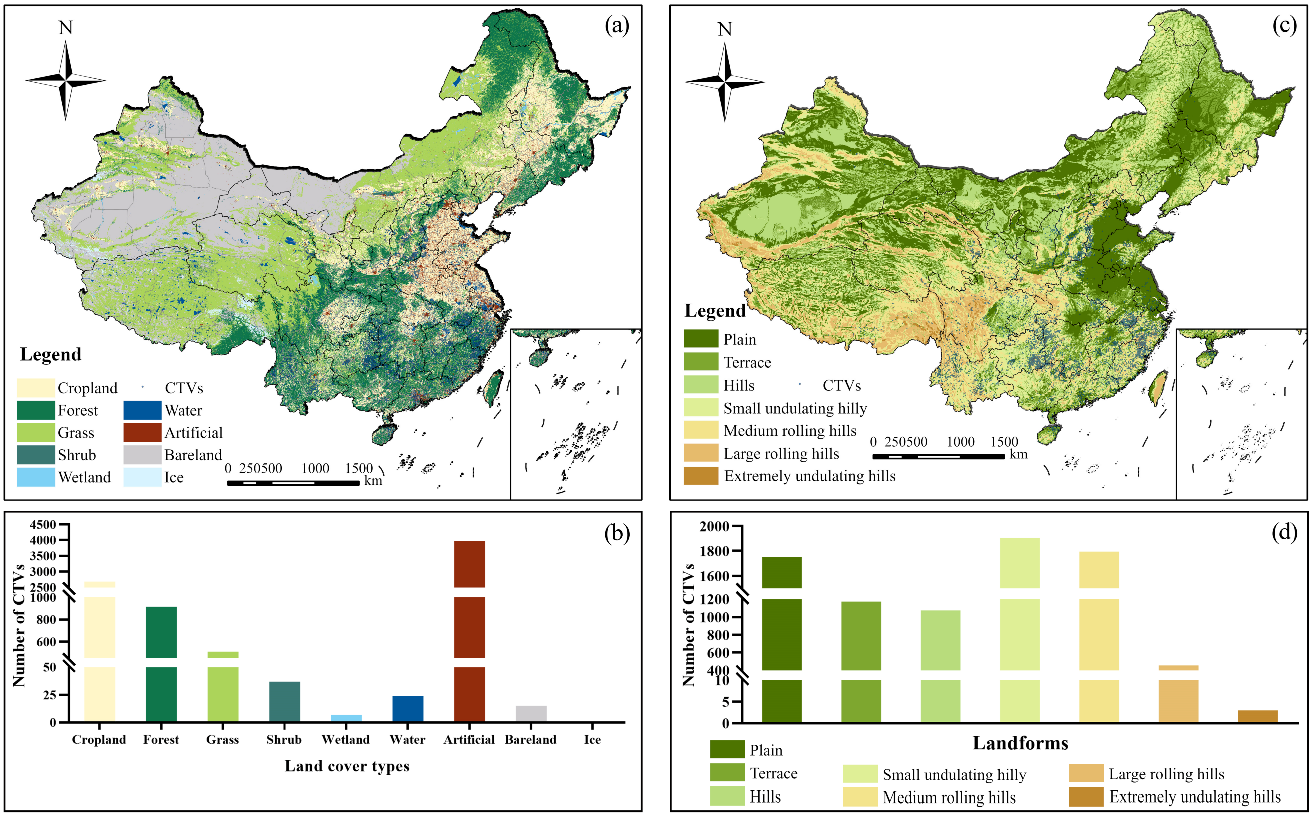

Figure 10. Analyzing the correlation between traditional village distribution and land cover types and landforms. (**a**) Land cover types. (**b**) Count of CTVs categorized by land cover type. (**c**) Landforms. (**d**) Count of CTVs categorized by landform. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

4.2. Space Economy

SE is the fundamental premise for the existence and development of productivity within a specific geographical area [43]. The regular distribution of various material elements in the SE is often analyzed in geography, as are the interdependence and interconstrained relationships between the various sectors and regions that manifest themselves [44]. TVs cannot be created and developed without the support of a SE. Hence, this section investigates the spatial configuration of CTVs concerning population and GDP per capita, industry, urbanization, and transportation.

4.2.1. Population and GDP per Capita

We extracted the distribution of CTVs at each level using population and per capita GDP data from the seventh census, and the analysis results are presented in Figure 11. Interestingly, the districts with the most significant number of TVs are not the most or least populated but the middle level because highly urbanized and economically developed densely populated areas and sparsely populated areas with extreme geographical conditions often have only a few TVs that have achieved sustainable development. The relationship between the spatial configuration of TVs and per capita GDP in China follows a similar pattern. Economically less developed regions have less impact from construction activities, which is conducive to preserving TVs' historical and cultural heritage. However, there are still many TVs in highly populated and high per capita GDP regions such as Zhejiang and Guangdong, indicating that economic development positively affects the protection and development of TVs to some degree.

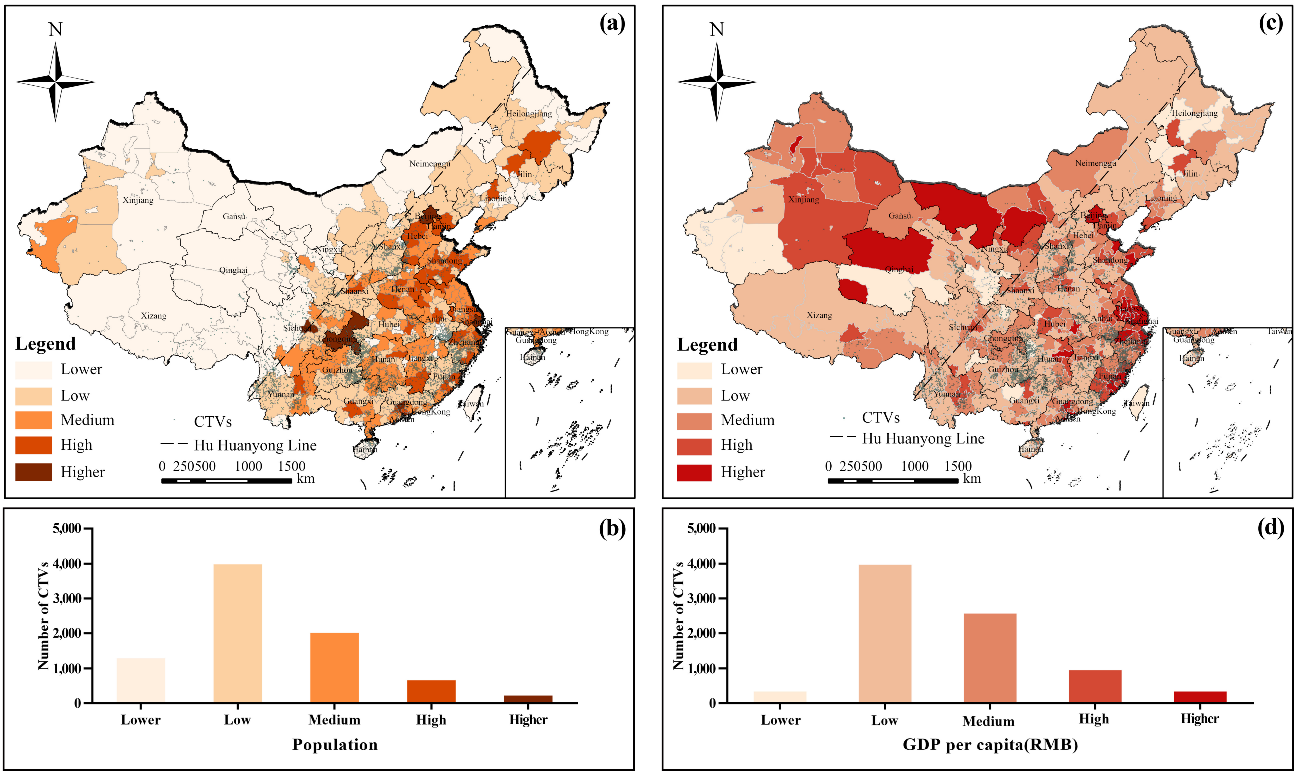

Figure 11. The relationships between the spatial configuration of TVs and population and GDP per capita. (**a**) Population. (**b**) Count of CTVs in each population range. (**c**) GDP per capita. (**d**) Count of CTVs in each GDP per capita range. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

4.2.2. Industry

Based on the data extracted from the statistical yearbooks of various provinces in China regarding the tertiary sector population and the count of large-scale industrial enterprises, the analysis results are presented in Figure 12. It is observed that the count of TVs increases with the expansion of the tertiary industry, reaching a peak before drastically declining. There are still numerous TVs, despite Beijing and Chongqing having the greatest concentration of tertiary sector populations in various regions. Furthermore, regarding large-scale enterprises, the quantity of TVs diminishes progressively as the count of large-scale enterprises increases. The count of TVs was at its highest at 6130, comprising 75.2% of the overall amount, while the number of large-scale enterprises was the lowest. Conversely, only 34 TVs remained when the number of large-scale enterprises was at its highest. Nevertheless, regions like Chongqing, Zhejiang, and Guangdong have still managed to preserve many TVs. In general, most TVs are far away from economically developed areas, but this does not imply that their development is hampered by economic development.

4.2.3. Urbanization and Transportation

The spatial configuration of TVs is closely linked to that of towns [20]. The spatial configuration of TVs has a statistical relationship with the location of county-level city governments and the density of the road network in each city, as shown in Figure 13. There are 2351 TVs within 15.5 km from the city, 3160 TVs between 15.5 km and 26.8 km, 2070 TVs between 26.8 km and 41.6 km, 538 TVs between 41.6 km and 80.9 km, and only 36 TVs with a distance of more than 81 km. There are only 36 TVs with a distance of more than 81 km, of which the farthest distance reaches 243.6 km. In general, TVs are predominantly situated about 30 km away from cities. This spatial arrangement allows them to remain relatively untouched by urban development, as they have limited contact with the outside world, thereby enabling the preservation of their distinctive cultural heritage.

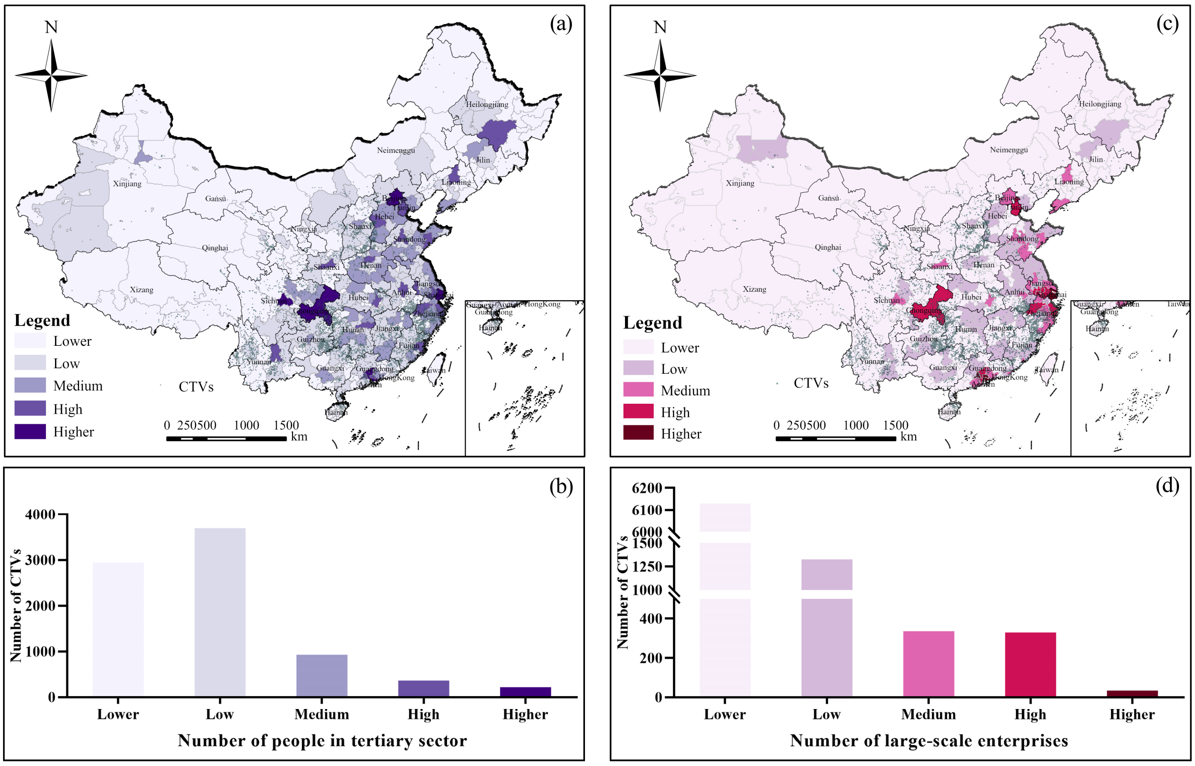

Figure 12. The relationships between the spatial configuration of TVs and industry. (**a**) People in the tertiary sector. (**b**) Count of CTVs in each tertiary sector population range. (**c**) Number of large-scale enterprises. (**d**) Count of CTVs in each large-scale enterprise range. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

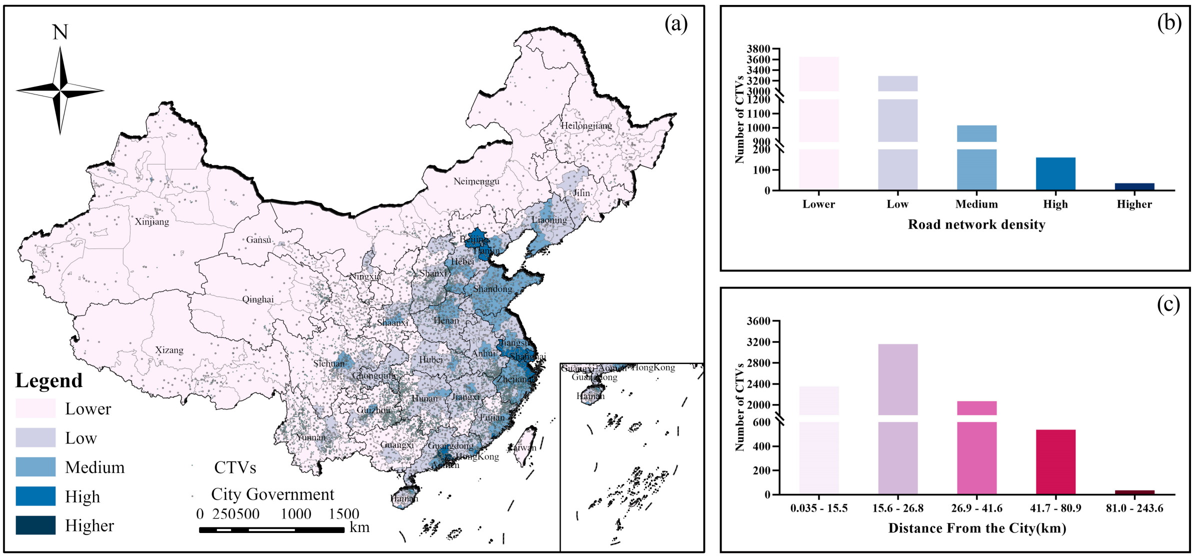

Figure 13. The relationships between the spatial configuration of TVs and urbanization and transportation. (**a**) Road density. (**b**) Count of CTVs at each road density. (**c**) Count of CTVs within the distance range of each city. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

Roads are the key to connecting the countryside to the city and transforming TVs into modern ones [45]. The analysis shows a gradual decline in the number of CTVs as the density of regional roads increases. TVs were predominantly located in areas with the lowest road density, comprising 44.8% of the total, with 3651 villages. Conversely, only 36 TVs were present when the road network density was the highest. Despite high road densities in areas such as Shandong, Jiangsu, Zhejiang, and Henan, where TVs are concentrated, most TVs are still found in areas with low road density, which suggests that most TVs are isolated from outside interference and are relatively inaccessible, which contributes to the preservation of their unique traditional culture.

4.3. Social Culture

Culture is the key to inheriting TVs. There are 56 ethnic groups in China, and many ethnic groups have created colorful and characteristic cultures and languages. At the same time, the remaining material and non-material cultures affect the inheritance and development of TVs. Furthermore, prior research has demonstrated an explicit coupling between the spatial configuration of TVs and scenic areas [46]. Therefore, this part discusses the relationship with the distribution of TVs from three aspects: cultural heritage, scenic spots, and ethnicity and language.

4.3.1. Cultural Heritage

By performing kernel density analysis and utilizing collected point data from National Intangible Cultural Heritages (NICHs), National Intangible Cultural Heritage Inheritors (NICHIs), and National Cultural Protection Units (NCPUs), we can extract the count of TVs at various levels of density. The result is shown in Figure 14. The distribution of CTVs and the density hierarchy of NICHs show an inverted U-shaped distribution. The count of TVs exhibits an initial increase and subsequent decrease as the density of NICHs increases. It is found from the figure that most of the areas where traditions are concentrated are also areas where NICHs are concentrated. In addition, the areas with high-density layers are the most economically developed places, such as the cities of Beijing and Shanghai. The more the economy develops, the higher the likelihood of encroaching on land resources, resulting in the conversion of numerous villages into urban areas. However, these areas have better systems for protecting various types of cultural heritage. The distribution of NICHIs shows the same inverted U-shaped distribution as that of CTVs. After reaching its peak at the middle-density layer, there is a sharp decline, indicating that the concentration of TVs does not necessarily correspond to a concentration of material culture genetic inheritors. The same is true for the distribution of CTVs and the density of NCPUs. The density analysis shows a steep increase and then a decrease in the count of TVs. Generally, the areas where TVs are concentrated also have cultural heritage. The peak of the spatial agglomeration of TVs is mainly located at the southeast border of Shaanxi and the junction of Anhui and Zhejiang, which coincides with the distribution of cultural heritage.

4.3.2. Ethnicity and Language

We utilized data on the proportion of minority populations, clan genealogies, and language areas in each prefecture-level city to extract the distribution number of CTVs in layers. Figure 15 displays the results. We found that the distribution number of TVs exhibits a leap-forward change with the ratio of the minority population. The region with the smallest minority population has the most extensive distribution of TVs, accounting for 36.5%. Conversely, when the ratio of the minority population is the largest, the number of TVs reaches 1456, accounting for 17.9% of the total. Areas with a large ratio of ethnic minorities, such as Tibet, western Xinjiang, and southwestern Guangxi, have fewer TVs due to the extreme environment being unsuitable for living. In contrast, developed provinces with small minority populations, such as Zhejiang and Fujian, have a clustered distribution of TVs due to their developed economies, abundant resources, and more robust traditional culture protection systems. Regarding the count of genealogies, the count of TVs decreases as the count of genealogies increases. However, the area with the largest number of genealogies has the densest distribution of TVs. The continuation of the genealogy requires a specific material foundation. Genealogy is more likely to survive in resource-rich regions like Zhejiang and Fujian. With regard to language areas, the concentration of TVs is highest in the official language zone and the Chinese language zone, with a total of 7623 villages comprising 93.5% of the overall amount. TVs in minority language areas, which are mostly located in regions with extreme natural conditions, are scattered and only number 520. In general, the spatial configuration of TVs is closely relevant to the population, genealogy, and language of ethnic minorities, and there are apparent spatial distribution differences.

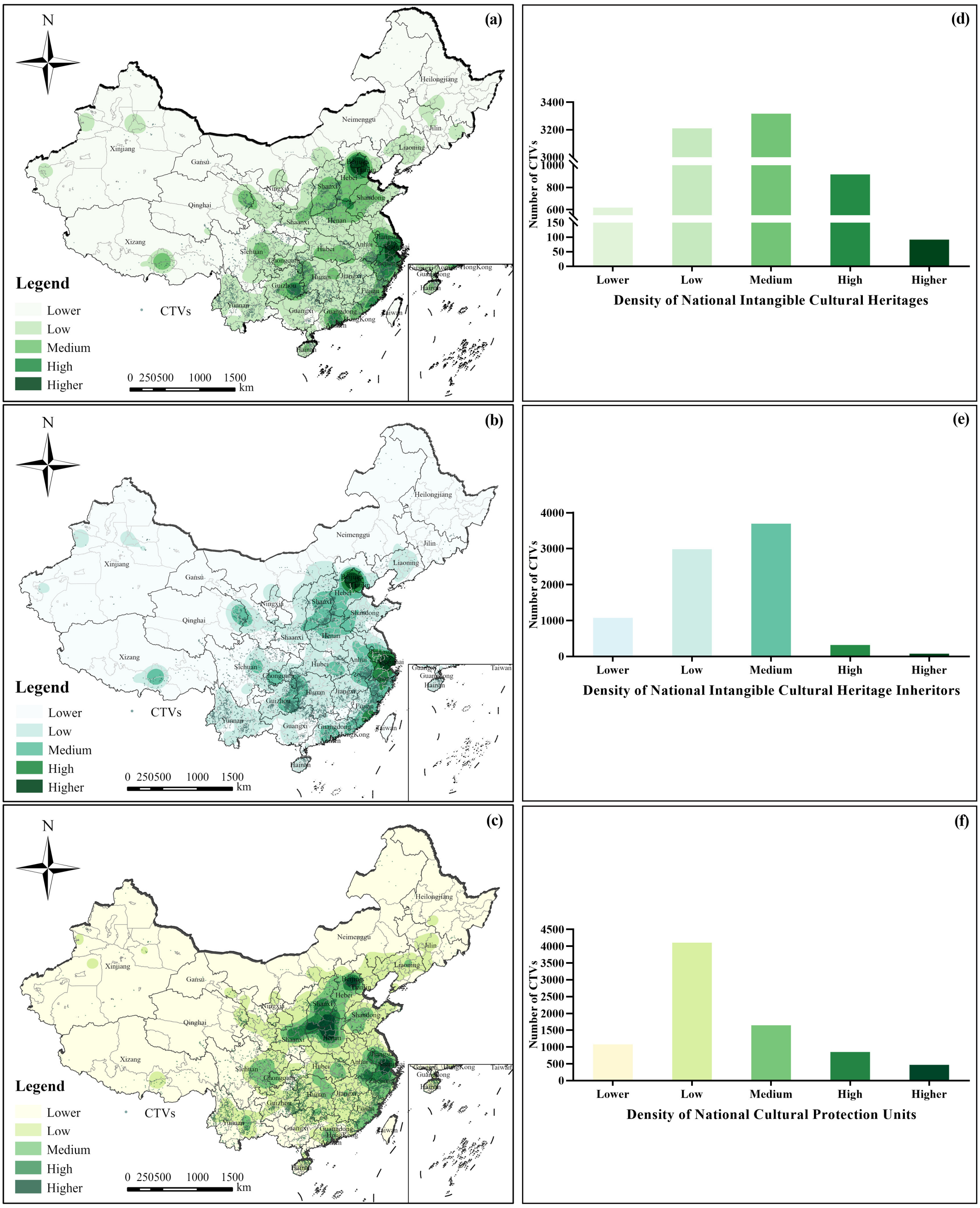

Figure 14. The relationship between the spatial configuration of TVs and cultural heritage. (**a**) The density of NICH. (**b**) The density of NICHI. (**c**) The density of NCPU. (**d**) Count of CTVs categorized by the density of NICH. (**e**) Count of CTVs categorized by the density of NICHI. (**f**) Count of CTVs categorized by the density of NCPU. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

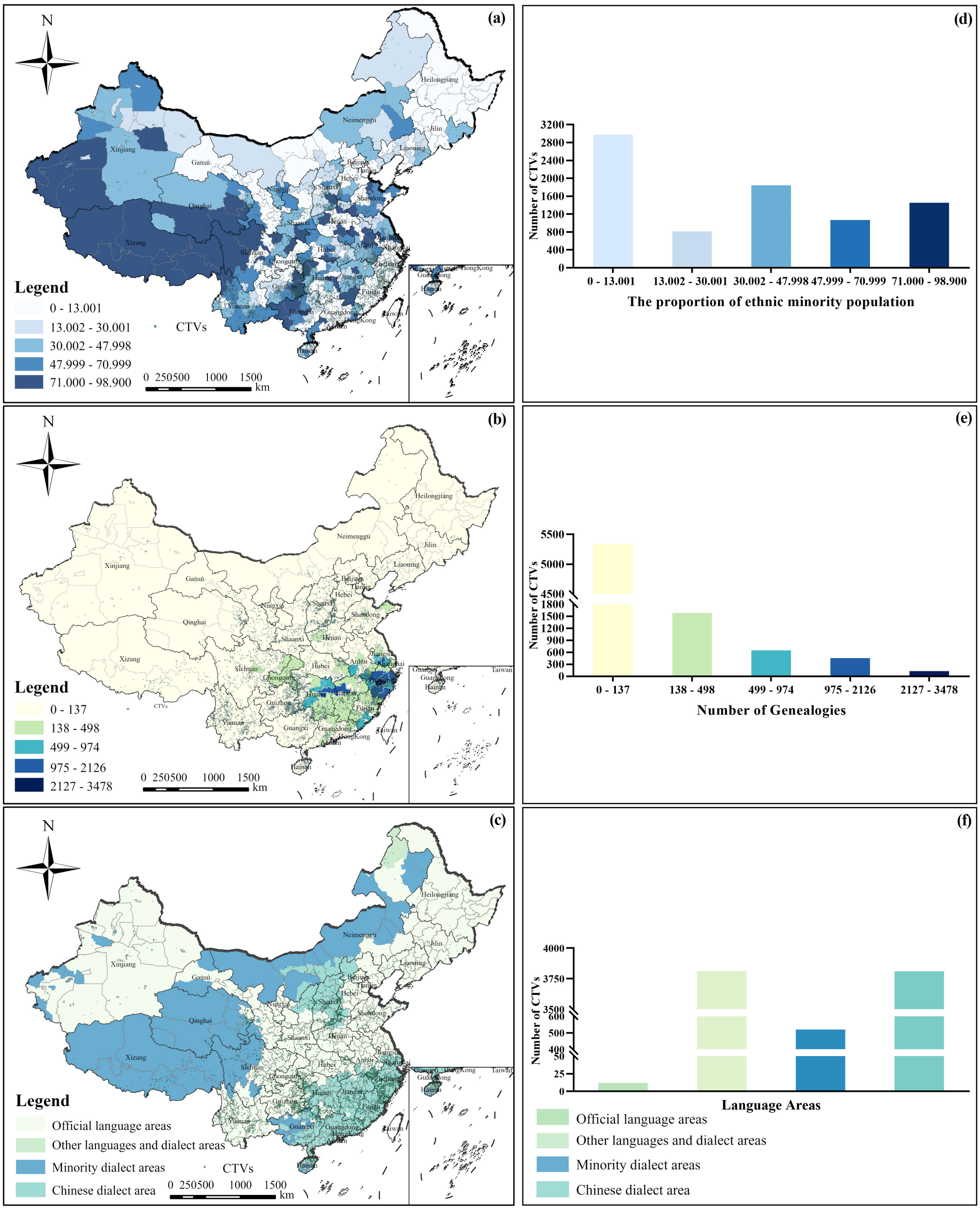

Figure 15. The relationships between the spatial configuration of TVs and ethnicity and language. (**a**) The proportion of the ethnic minority population. (**b**) Number of clan genealogies. (**c**) Language areas. (**d**) Count of CTVs in each ethnic minority population range. (**e**) Count of CTVs in each genealogical quantity range. (**f**) Count of CTVs in each language area. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

4.3.3. Scenic Area

Using the point data of China's national A-class tourist attractions and national parks, we applied the same analytical approach as described previously, and the outcomes are illustrated in Figure 16. According to statistics, when the density of scenic areas increases, the distribution of CTVs initially rises and then falls. The spatial configuration of most scenic areas is concentrated in the southeast coast and Beijing regions, with some agglomerations in the inner hinterland. However, the spatial configuration of TVs in these districts is not concentrated. Most areas where TVs are distributed have a medium density of scenic area coverage, which may be because the coastal zone has not only rich natural landscapes but also a more developed economy than the inner hinterland, with well-developed institutional systems and material wealth support, resulting in a large number of national A-class scenic spots and scenic areas. Consequently, the distribution of TVs in these areas is relatively less concentrated.

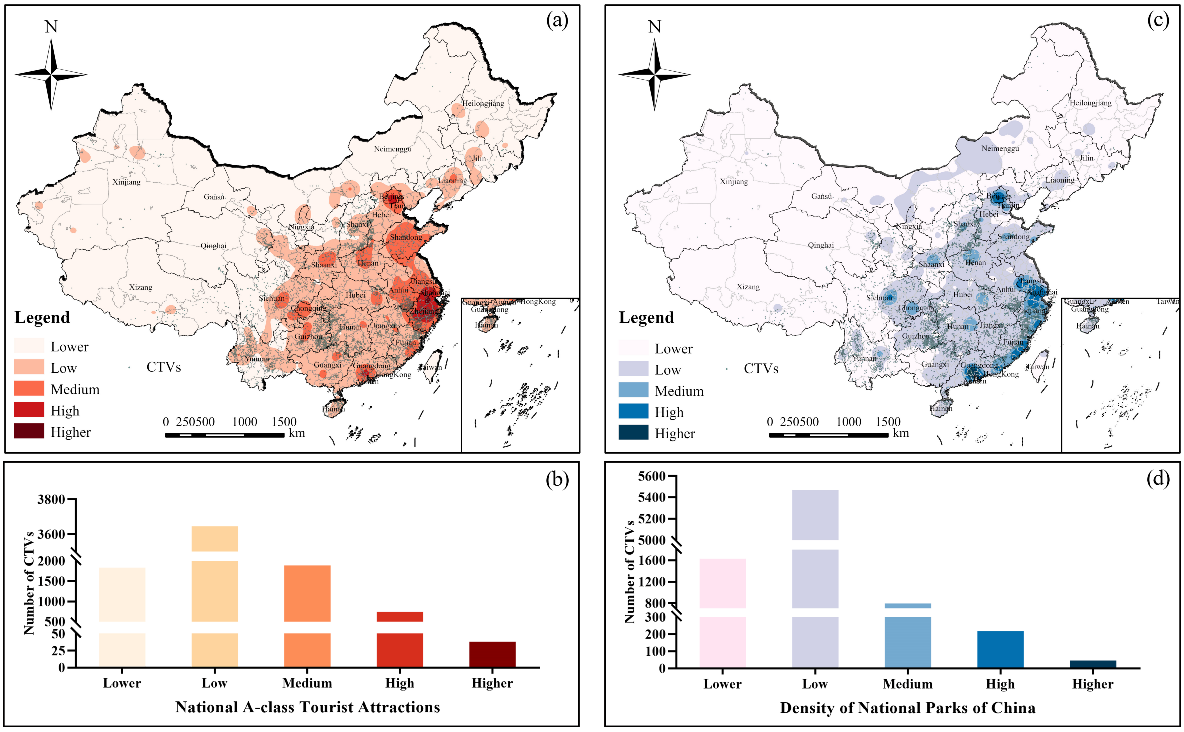

Figure 16. The relationships between the spatial configuration of TVs and the scenic area. (**a**) The density of national A-class tourist attractions. (**b**) Count of CTVs by the density of national A-class tourist attractions. (**c**) Density of national parks in China. (**d**) Count of CTVs by the density of national parks in China. The maps were generated by ArcGIS 10.6 and are for illustrative purposes only.

4.4. Comprehensive Impact Factor Analysis

4.4.1. Optimal Discretization of Continuous Variables

Based on the OPbGD model, this research applied four distinct approaches, including equal, natural, quantile, and geometric methods, to discretize the continuous driving factors of different categories. The corresponding q-values were calculated and are depicted in Figure 17. In order to precisely evaluate the extent of influence exerted by these factors on the spatial patterns of traditional villages, the optimal classification was determined by selecting the discretization with the highest q-value, which was subsequently employed for the subsequent exploratory analysis. The optimal discretization outcomes for each continuous driving factor are presented in Table 3.

Table 3. Optimal discretization results for continuous drivers.

Continuous Variable	Discretization Method	Optimal Classification	Continuous Variable	Discretization Method	Optimal Classification
ELE	Quantile	15	DoNATA	Quantile	12
RE	Natural	13	DoNPoA	Quantile	13
DW	Quantile	14	POP	Quantile	15
DoNICH	Natural	15	GDP	Quantile	11

Table 3. *Cont.*

Continuous Variable	Discretization Method	Optimal Classification	Continuous Variable	Discretization Method	Optimal Classification
DoNICHI	Natural	13	TP	Quantile	15
DoNCPU	Natural	13	NoLSE	Quantile	14
NoM	Quantile	15	URB	Natural	14
NoG	Quantile	15	TRA	Quantile	14

Figure 17. The best discretization results for each driving factor.

4.4.2. Single Factor Detection

The q-values representing the influence of various driving factors on the spatial patterns of TVs are illustrated in Figure 18. Moreover, all factors exhibit *p*-values below

0.01, signifying the appropriateness of utilizing the OPbGD model for the analysis of TV spatial configuration. The outcomes demonstrate that social-cultural and spatial-economic factors exert a more pronounced impact on the spatial patterns of traditional villages. Notably, DoNICHI possesses the highest q-value of 0.528, followed by DoNICH and NoG. Furthermore, other factors such as POP, NoLSE, and TRA also exhibit q-values exceeding 0.4. Overall, except for LZ, URB, and the NE factors, the influence of the remaining factors surpasses the mean value of 0.255, indicating that these factors are the primary determinants of the spatial patterns of TVs.

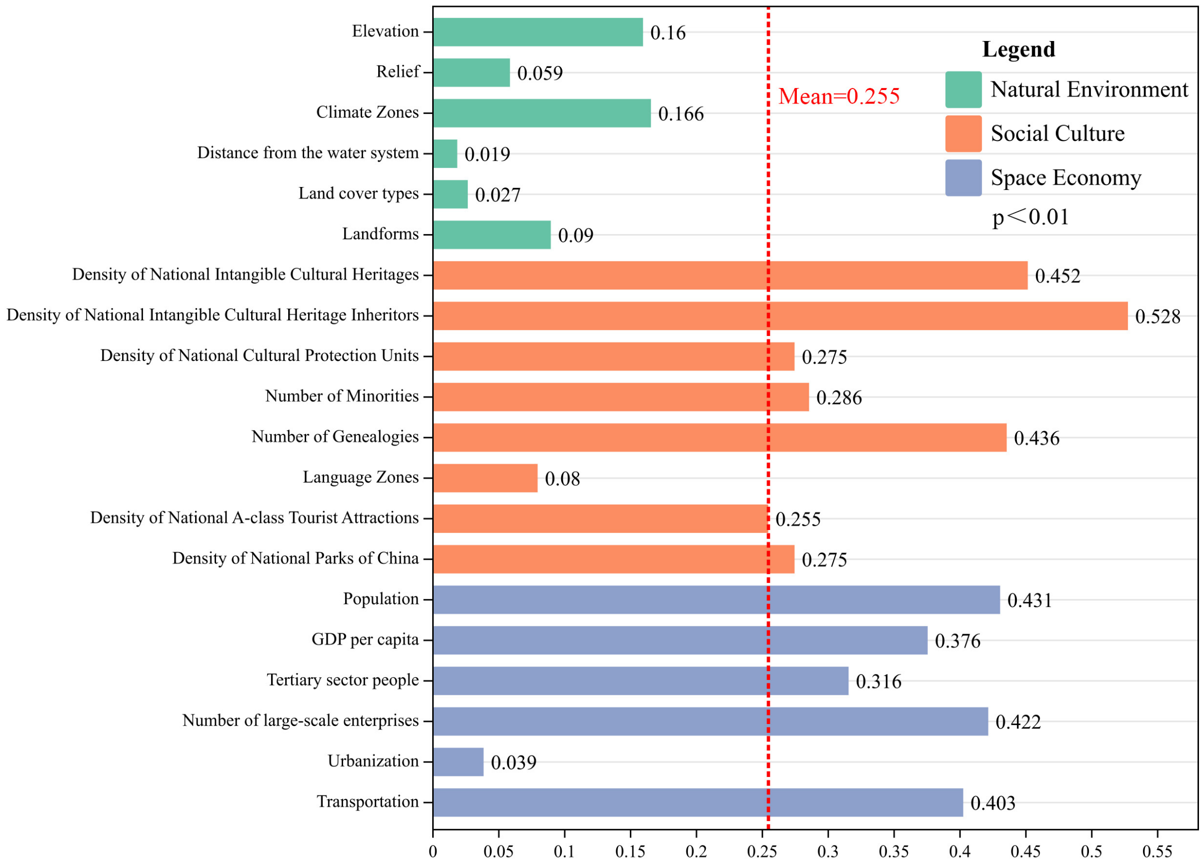

Figure 18. Evaluation results of the impact of various factors on the spatial configuration of CTVs.

In a broader context, TVs represent the products of a particular historical epoch. Throughout societal progress, many factors have influenced TVs' preservation and transformation [47]. During the initial stages of TV formation, the natural environment stands as the primary determinant shaping their spatial patterns. It was the foremost consideration for ancient inhabitants when selecting suitable settlement locations, as the availability of favorable living conditions and ample material resources were crucial for the perpetuation and advancement of village communities. However, as time advances, culture assumes the second position as a determining factor in traditional village distribution, ultimately emerging as the most significant influence. Culture embodies TVs' spiritual and foundational essence, and the absence of cultural vitality inevitably impedes their sustainable development. Concurrently, cultural formation entails expanding spatial-economic elements such as population, industries, and transportation. Some villages endowed with favorable geographic conditions evolve into towns or sprawling cities. Consequently, numerous CTVs preserving distinct cultural legacies unavoidably succumb to the flow of history. This reality underscores the pivotal role of SE factors in preserving and developing TVs. Thus, compared to NE factors, SC and SE factors exert a more pronounced influence on the spatial layout of TVs, with SC factors occupying the most significant prominence.

4.4.3. Factor Interplay Detection

Based on the detection of 20 individual factors, the interaction effects among these factors were further explored, and a heatmap was generated based on the results (Figure 19). The results indicate that the mean value of the interaction effects, q = 0.5, is 96% higher than the mean value of q obtained from individual factor detection. Moreover, the driving forces of each factor on the spatial distribution of CTVs in China are not independent but exhibit nonlinearity (120 pairs) or enhanced effects resulting from interactions between two factors (46 pairs), which suggests that the interaction effects between any two factors among the selected 20 influencing factors have a more significant driving influence on the spatial distribution patterns of CTVs in China. Therefore, it is evident that the interplay among these factors holds greater explanatory power in understanding the regional variations in the spatial distribution characteristics of CTVs.

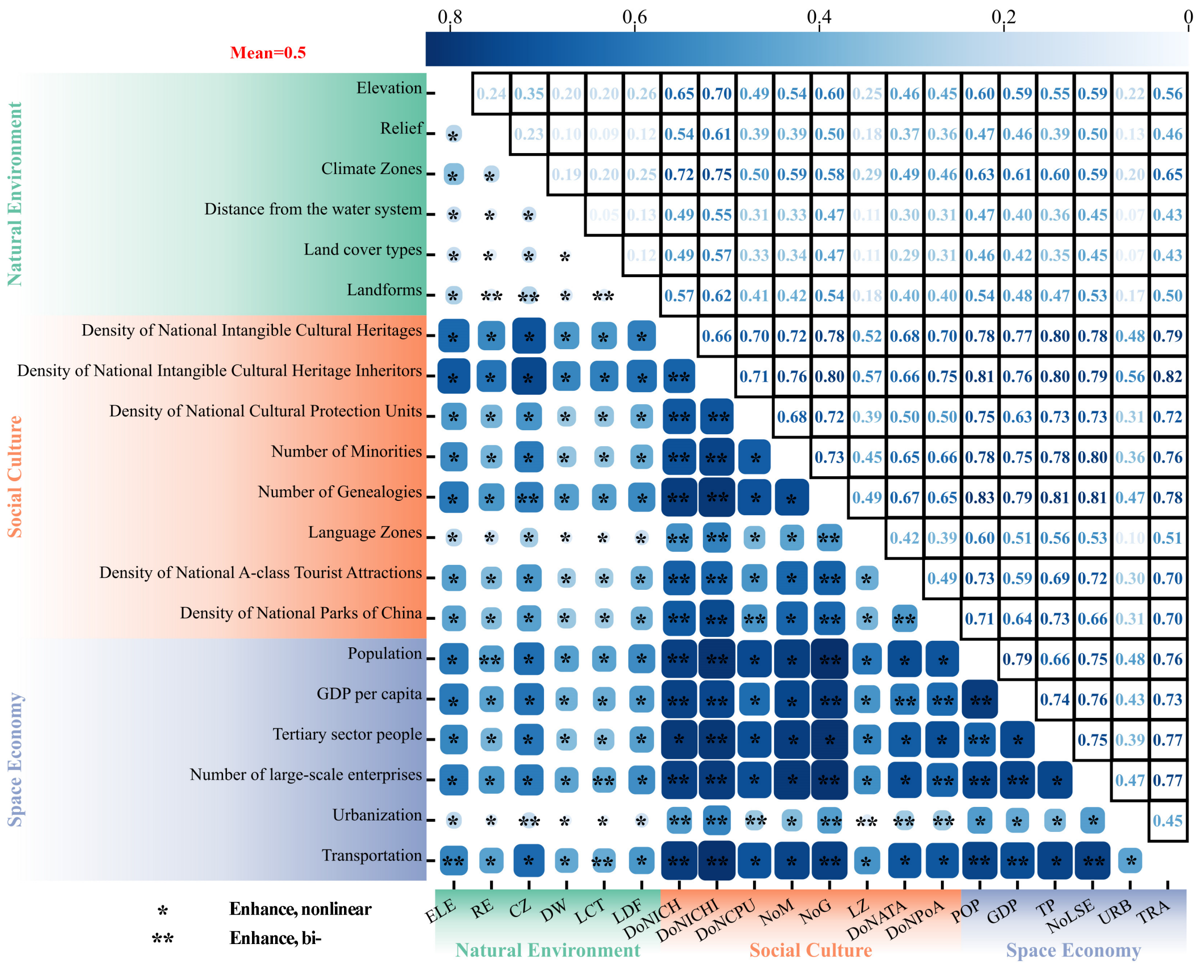

Figure 19. Interplay detected results of elements influencing the spatial configuration of CTVs.

Table 4 presents the interactions among the top nine drivers based on the q-value. The highest q-value is 0.827 for the interaction between NoG and POP, indicating that NoG and POP are the two key factors influencing the spatial patterns of CTVs, which suggests that areas with a higher number of genealogical records and larger populations tend to be gathering places for TVs. Firstly, regions with a greater abundance of genealogical records are associated with a more profound and diverse heritage of ethnic culture, fostering a stable environment for cultural preservation and transmission. Secondly, a larger population provides the necessary conditions for the continuity and propagation of cultural practices. The synergistic interaction between these two factors contributes to the sustainable development and preservation of TVs.

Table 4. Interactions among the top nine drivers of the q-value.

Rank	Interactive Variable ($x_a \cap x_b$)	Interaction Type	q-Value	Enhanced Compared to x_a	Enhanced Compared to x_b
1	NoG∩POP	Enhance, bi-	0.82663	+89.71%	+91.95%
2	DoNICHI∩TRA	Enhance, bi-	0.81260	+58.54%	+101.46%
3	NoG∩NoLSE	Enhance, bi-	0.81257	+86.48%	+92.76%
4	NoG∩TP	Enhance, nonlinear	0.81136	+86.20%	+156.89%
5	DoNICHI∩POP	Enhance, bi-	0.81080	+58.19%	+88.28%
6	DoNICHI∩TP	Enhance, bi-	0.80440	+56.94%	+154.69%
7	DoNICHI∩NoG	Enhance, bi-	0.80076	+56.23%	+83.77%
8	NoM∩NoLSE	Enhance, nonlinear	0.79821	+179.26%	+89.36%
9	DoNICH∩TP	Enhance, nonlinear	0.79147	+76.27%	+150.59%

Table 5 presents the findings of the interaction analysis, focusing on the 12 pairs of factors that exhibit an enhancement of over 100% compared to the individual impact q-values. Notably, the interaction between CZ and NoM stands out with a q-value of 0.591, representing the highest enhancement of 255.13% compared to the individual q-value of CZ, which is followed by the interactions of RE∩URB (+219.48%) and RE∩LZ (+206.57%). Notably, all the interactions exhibiting an enhancement of over 100% demonstrate a non-linear amplification effect. These findings suggest that the combined influence of these factors, under interactive effects, exerts a more pronounced impact on the spatial patterns of CTVs.

Table 5. The 12 interaction factors whose interaction q-value enhancement exceeds 100%.

Rank	Interactive Variable ($x_a \cap x_b$)	Interaction Type	q-Value	Enhanced Compared to x_a	Enhanced Compared to x_b
1	NoM∩TP	Enhance, nonlinear	0.78380	+174.22%	+148.17%
2	NoM∩GDP	Enhance, nonlinear	0.75142	+162.89%	+132.64%
3	DoNCPU∩TP	Enhance, nonlinear	0.72819	+177.36%	+130.56%
4	DoNATA∩TP	Enhance, nonlinear	0.70868	+164.60%	+124.38%
5	DoNCPU∩NoM	Enhance, nonlinear	0.67153	+155.78%	+134.94%
6	NoM∩DoNATA	Enhance, nonlinear	0.65917	+130.62%	+146.12%
7	NoM∩DoNPoA	Enhance, nonlinear	0.65731	+129.96%	+139.15%
8	DoNATA∩GDP	Enhance, nonlinear	0.64982	+142.63%	+101.19%
9	CZ∩NoM	Enhance, nonlinear	0.59091	+255.13%	+106.73%
10	ELE∩CZ	Enhance, nonlinear	0.35046	+119.31%	+110.62%
11	RE∩LZ	Enhance, nonlinear	0.18058	+206.57%	+126.11%
12	RE∩URB	Enhance, nonlinear	0.12489	+112.02%	+219.48%

Note: Darker colors indicate greater enhancement strength.

5. Interplay Mechanism of NE-SC-SE

Forming the spatial pattern of CTVs is an evolving, complex, and changeable process. It mainly comprises three aspects: NE, SC, and SE, as shown in Figure 20. Space is a product of society. It is divided into spiritual space, material space, and social space in terms of space types [48]. The three elements of space are neither mixed nor separated, and they must be treated, conceived, and perceived simultaneously and exist in life [49]. Each of the three elements implies and presupposes the other two [49]. The spatial evolution of CTVs is not only a change in physical space but also a comprehensive reflection of changes in social production relations, culture, and ideology [50]. In the evolution of various types of spaces, positive and negative externalities are constantly generated between each other [51]. The advent of science and technology through the SE has significantly hastened urbanization, leading to the encroachment of traditional village spaces. However, it has also improved the material foundation, social relationships, and cultural awareness of these TVs. Culture is also developing and being eliminated in the interplay process of various human activities. While the NE protects the inhabitants, it also hinders the exchange of information. It is in this space that the villages are constantly exchanging with the city; the villages with unstable space are eliminated, and the villages with stable space are preserved.

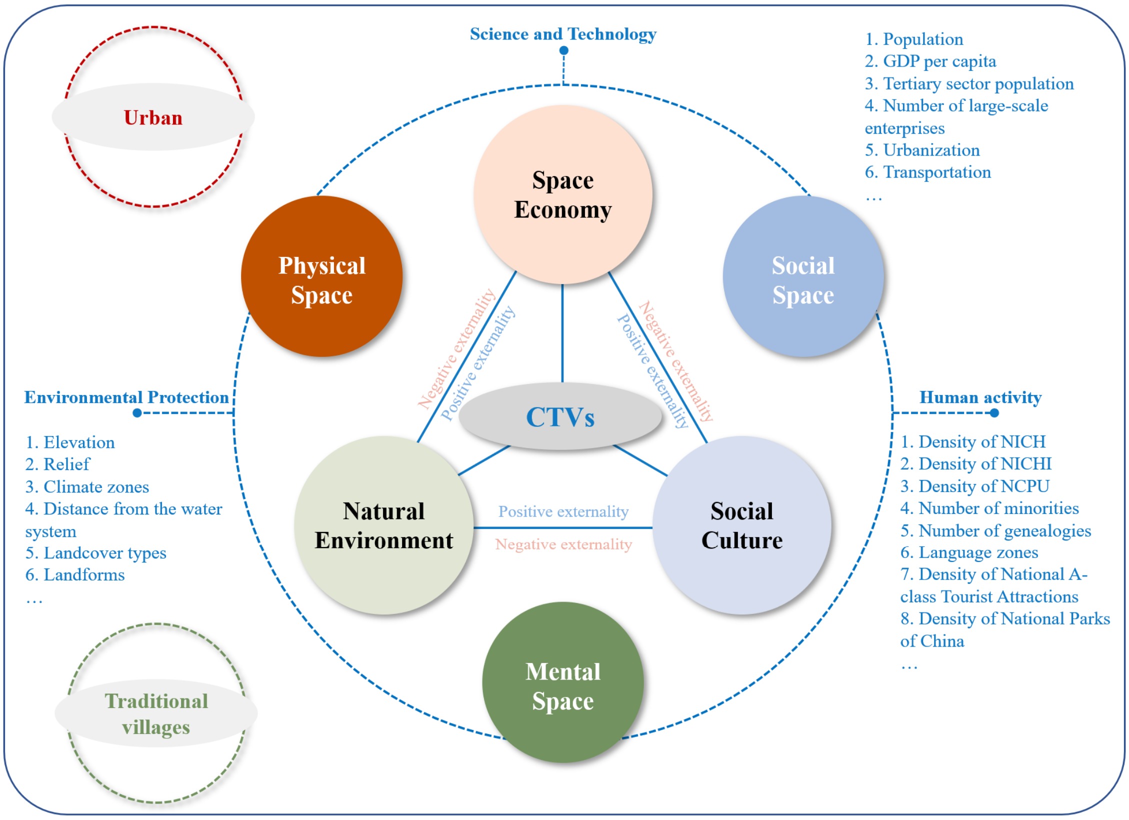

Figure 20. Interplay mechanism of NE-SC-SE.

In summary, the NE serves as the "cornerstone" for the formation and continuation of CTVs, playing a crucial role in their spatial configuration. It determines the development direction of their spatial location. SC is the primary internal driving factor of the spatial differentiation of CTVs and the second most important factor that reinforces the uneven spatial configuration of TVs. Simultaneously, forming diverse cultures involves expanding spatial-economic factors such as population, industries, and transportation. Villages with favorable geographical conditions sometimes undergo urban development and even transform into large cities. Consequently, many TVs with unique cultural legacies have unavoidably faded away throughout history. This phenomenon highlights the crucial role of spatial-economic elements in the inheritance and development of traditional villages. Thus, compared to natural environmental factors, social-cultural and spatial-economic factors have a notably pronounced impact on the spatial distribution of traditional villages, with social-cultural factors exerting the most significant influence.

6. Conclusions and Discussion

6.1. Conclusions

This research focuses on the spatial configuration of CTVs using various analytical methods such as Ripley's K-function, GCI, IMI, kernel density, and spatial autocorrelation. Through the OPbGD model, the driving factors behind the distribution pattern are revealed. The following findings are reached:

(1) The spatial configuration of CTVs shows notable spatial agglomeration and differentiation. Moran's *I*, which is 0.309, indicates significant clustering. The GCI ranges from 31.473 to 77.055 among provinces, with substantial variation. The IMI ranges from 0.369 to 0.95, showing significant disparities in the distribution equilibrium of TVs in each province. Kernel density analysis reveals that the spatial configuration of CTVs

generally follows the features of "three centers and two secondary centers". Among them, the three centers are located at the junction of the "Shaanxi-Henan-Hebei" border, the "Anhui-Zhejiang-Fujian" contiguous area, and the "Hunan-Chongqing-Guizhou-Guangxi" contiguous area. The two secondary centers are located east of Qinghai and northwest of Yunnan. According to the analysis of local hotspots, at the provincial level, TVs are most concentrated in Guizhou, Guangzhou, and Jiangxi, followed by Yunnan, and finally, Hunan, Fujian, and Guangzhou. On the city scale, TVs are mainly concentrated in four areas. The first is the southeastern part of Shaanxi; the second is the border of Hunan, Hubei, Chongqing, Guizhou, and Guangxi; the third is the border of Zhejiang, Anhui, Jiangxi, and Fujian; and the fourth is located on the border of southwest Yunnan.

(2) Based on the results of the single-factor analysis, the spatial patterns of CTVs are primarily influenced by DoNICHI, DoNICH, NoG, POP, NoLSE, and TRA, with q-values above 0.4 for these factors. Considering the baseline q-value mean of 0.255, except for LZ, URB, and NE factors, the influence of the remaining factors exceeds 0.255, indicating that SC and SE factors have a more significant impact on the spatial patterns of CTVs.

Regarding the interaction analysis results, the highest q-value for the interaction between NoG and POP is 0.827, which is followed by DoNICHI∩TRA (0.8126), NoG∩IN (0.81257), and NoG∩TP (0.81136). In terms of enhancing the q-values compared to individual effects, the interaction between CZ and NoM reaches a q-value of 0.591, exhibiting the highest enhancement of 255.13% compared to the individual q-value of CZ. Subsequently, RE∩URB (+219.48%) and RE∩LZ (+206.57%) demonstrate that these factors have a more pronounced influence on the spatial patterns of CTVs under interactive effects.

6.2. Discussion

6.2.1. Exploring the Main Driving Factors in the Spatial Configuration of CTVs

Natural, environmental, and economic influences have been explored in many studies. In the research conducted by HeDan Ma et al. on the traditional spatial distribution in southwest China, factors such as topography, elevation, population, ethnicity, regional economic development, central town, and road traffic were considered [20]. Similarly, Haoran Su et al. explored the spatial distribution characteristics of TVs in China by taking into account factors such as road density, river density, elevation, topographic relief, population density, GDP density, annual rainfall, average annual temperature, and NDVI [52]; Chenge Gao et al. investigated the spatial configuration of TVs in the Yellow River basin using factors such as elevation, ruggedness, distance to the nearest river, GDP per capita, and others. However, existing research has paid limited attention to the influence of cultural factors, and there need to be more studies that have further explored the effects of interaction among various factors. Moreover, the influencing factors of spatial patterns in TVs are complex and diverse. Considering the unilateral impact of a single factor alone is insufficient. Therefore, this study addresses this research gap by considering multiple social-cultural factors and investigating the interaction among these influencing factors. The aim is to provide a more scientific understanding of the mechanisms through which various geographical elements influence the spatial patterns of CTVs.

However, this study did not investigate the regional variations in the distribution of TVs across different watersheds and areas. Additionally, it did not explore the micro-scale attributes or specific case studies. Therefore, future research should focus on examining the spatial distribution patterns of TVs in different watersheds and regions, as well as investigating the micro-level characteristics and specific case studies.

6.2.2. Concentrated Contiguous Protection Strategy of CTVs

TVs in the same region with a comparatively stable living environment will be influenced by a comparatively stable historical and cultural endowment. They will have similar folk traits, cultural environments, and development needs [20]. Moreover, the villages have a point-group structure in geographical space. The characteristics of settlements are derived from different geographical environments, a relationship based on commonality rather than individuality. Therefore, it is worthwhile to investigate the protection and utilization of concentrated contiguous TVs. By treating these villages as nodes and connecting them together to form a patch, the potential of the area's national intangible cultural heritages, national intangible cultural heritage inheritors, genealogies, national cultural protection units, national A-class tourist attractions, national parks of China, and other characteristic resources can be fully utilized. Through the realization of scale and diversification of resources and promoting the integration and development of primary, secondary, and tertiary industries, as well as attracting social capital participation, we can address the problems of single and homogeneous industrial development methods in TVs.

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References

1. Klokov, K. Substitution and Continuity in Southern Chukotka Traditional Rituals: A Case Study from Meinypilgyno Village, 2016–2017. *Arct. Anthropol.* **2018**, *55*, 117–133. [CrossRef]
2. Nie, Z.; Li, N.; Pan, W.; Yang, Y.; Chen, W.; Hong, C. Quantitative Research on the Form of Traditional Villages Based on the Space Gene—A Case Study of Shibadong Village in Western Hunan, China. *Sustainability* **2022**, *14*, 8965. [CrossRef]
3. Prasiasa, D.P.O.; Widari, D. Traditional agricultural system as tourism icon in jatiluwih tourism village, tabanan regency, bali province. *J. Asian Dev.* **2019**, *5*, 89–100. [CrossRef]
4. Liu, C.; Xu, M. Characteristics and Influencing Factors on the Hollowing of Traditional Villages—Taking 2645 Villages from the Chinese Traditional Village Catalogue (Batch 5) as an Example. *Int. J. Environ. Res. Public Health* **2021**, *18*, 12759. [CrossRef] [PubMed]
5. Song, W.; Liu, M. Assessment of decoupling between rural settlement area and rural population in China. *Land Use Policy* **2014**, *39*, 331–341. [CrossRef]
6. Tan, M.; Li, X. The changing settlements in rural areas under urban pressure in China: Patterns, driving forces and policy implications. *Landsc. Urban Plan.* **2013**, *120*, 170–177. [CrossRef]
7. Liu, Y.; Ou, C.; Li, Y.; Zhang, L.; He, J. Regularity of rural settlement changes driven by rapid urbanization in North China over the three decades. *Sci. Bull.* **2023**, *68*, 2115–2124. [CrossRef]
8. Liu, Y.; Li, Y. Revitalize the world's countryside. *Nature* **2017**, *548*, 275–277. [CrossRef]
9. Stone, K.H. The Development of a Focus for the Geography of Settlement. *Econ. Geogr.* **1965**, *41*, 346–355. [CrossRef]
10. Verdini, G.; Frassoldati, F.; Nolf, C. Reframing China's heritage conservation discourse. Learning by testing civic engagement tools in a historic rural village. *Int. J. Herit. Stud.* **2017**, *23*, 317–334. [CrossRef]
11. Ye, C.; Liu, Z. Rural-urban co-governance: Multi-scale practice. *Sci. Bull.* **2020**, *65*, 778–780. [CrossRef] [PubMed]
12. Li, Y.; Li, J.; Chu, J. Research on the revitalization of Huizhou traditional villages based on the PAF model. *J. Asian Archit. Build. Eng.* **2023**, *22*, 3703–3717. [CrossRef]
13. Wang, H.-F.; Chiou, S.-C. Research on the Sustainable Development of Traditional Dwellings. *Sustainability* **2019**, *11*, 5333. [CrossRef]
14. Torreggiani, D.; Ludwiczak, Z.; Dall'Ara, E.; Benni, S.; Maino, E.; Tassinari, P. TRuLAn: A high-resolution method for multi-time analysis of traditional rural landscapes and its application in Emilia-Romagna, Italy. *Landsc. Urban Plan.* **2014**, *124*, 93–103. [CrossRef]
15. Yang, X.; Pu, F. Cellular Automata for Studying Historical Spatial Process of Traditional Settlements Based on Gaussian Mixture Model: A Case Study of Qiaoxiang Village in Southern China. *Int. J. Archit. Herit.* **2018**, *14*, 568–588. [CrossRef]

16. Shi, Z.; Ma, L.; Zhang, W.; Gong, M. Differentiation and correlation of spatial pattern and multifunction in rural settlements considering topographic gradients: Evidence from Loess Hilly Region, China. *J. Environ. Manag.* **2022**, *315*, 115127. [CrossRef]
17. Gong, J.; Jian, Y.; Chen, W.; Liu, Y.; Hu, Y. Transitions in rural settlements and implications for rural revitalization in Guangdong Province. *J. Rural Stud.* **2022**, *93*, 359–366. [CrossRef]
18. Bian, J.; Chen, W.; Zeng, J. Spatial Distribution Characteristics and Influencing Factors of Traditional Villages in China. *Int. J. Environ. Res. Public Health* **2022**, *19*, 4627. [CrossRef]
19. Xie, B.; Wei, W.; Li, Y.; Liu, C.; Ju, S. Research on Spatial Distribution Characteristics and Correlation Degree of the Historical and Cultural Towns (Villages) in China. *Sustainability* **2023**, *15*, 1680. [CrossRef]
20. Ma, H.; Tong, Y. Spatial differentiation of traditional villages using ArcGIS and GeoDa: A case study of Southwest China. *Ecol. Inform.* **2022**, *68*, 101416. [CrossRef]
21. Liu, X.; Yuan, L.; Tan, G. Identification and Hierarchy of Traditional Village Characteristics Based on Concentrated Contiguous Development—Taking 206 Traditional Villages in Hubei Province as an Example. *Land* **2023**, *12*, 471. [CrossRef]
22. Chen, W.; Yang, L.; Wu, J.; Wu, J.; Wang, G.; Bian, J.; Zeng, J.; Liu, Z. Spatio-temporal characteristics and influencing factors of traditional villages in the Yangtze River Basin: A Geodetector model. *Herit. Sci.* **2023**, *11*, 111. [CrossRef]
23. Wu, C.; Chen, M.; Zhou, L.; Liang, X.; Wang, W. Identifying the Spatiotemporal Patterns of Traditional Villages in China: A Multiscale Perspective. *Land* **2020**, *9*, 449. [CrossRef]
24. Jia, A.; Liang, X.; Wen, X.; Yun, X.; Ren, L.; Yun, Y. GIS-Based Analysis of the Spatial Distribution and Influencing Factors of Traditional Villages in Hebei Province, China. *Sustainability* **2023**, *15*, 9089. [CrossRef]
25. Li, T.; Li, C.; Zhang, R.; Cong, Z.; Mao, Y. Spatial Heterogeneity and Influence Factors of Traditional Villages in the Wuling Mountain Area, Hunan Province, China Based on Multiscale Geographically Weighted Regression. *Buildings* **2023**, *13*, 294. [CrossRef]
26. Yang, R.; Xu, Q.; Long, H. Spatial distribution characteristics and optimized reconstruction analysis of China's rural settlements during the process of rapid urbanization. *J. Rural Stud.* **2016**, *47*, 413–424. [CrossRef]
27. Gao, C.; Wu, Y.; Bian, C.; Gao, X. Spatial characteristics and influencing factors of Chinese traditional villages in eight provinces the Yellow River flows through. *River Res. Appl.* **2023**, *39*, 1255–1269. [CrossRef]
28. Li, X.; Yang, Q.; Lyu, X.; Ye, Y.; Zhang, B. Multidimensional framework for analyzing the distribution patterns of traditional villages in the karst landscape regions of China. *Ecol. Inform.* **2023**, *77*, 102184. [CrossRef]
29. Lu, M.; Wei, L.; Ge, D.; Sun, D.; Zhang, Z.; Lu, Y. Spatial optimization of rural settlements based on the perspective of appropriateness–domination: A case of Xinyi City. *Habitat Int.* **2020**, *98*, 102148. [CrossRef]
30. Liu, S.; Ge, J.; Bai, M.; Yao, M.; He, L.; Chen, M. Toward classification-based sustainable revitalization: Assessing the vitality of traditional villages. *Land Use Policy* **2022**, *116*, 106060. [CrossRef]
31. Ebrard Casaubon, M.; Frausto-Guerrero, A. Mexico, Culture and MONDIACULT 2022. *Rev. Mex. Política Exter.* **2022**, *123*, 5–8.
32. Voicu, I. Universal Declaration on Cultural Diversity. *ABAC J.* **2002**, *22*, 1–3.
33. Jinfeng, W.; Chengdong, X. Geodetector: Principle and prospective. *Acta Geogr. Sin.* **2017**, *72*, 116–134. (In Chinese) [CrossRef]
34. An, M.; Xie, P.; He, W.; Wang, B.; Huang, J.; Khanal, R. Spatiotemporal change of ecologic environment quality and human interaction factors in three gorges ecologic economic corridor, based on RSEI. *Ecol. Indic.* **2022**, *141*, 109090. [CrossRef]
35. Jiang, R.; Wu, P.; Song, Y.; Wu, C.; Wang, P.; Zhong, Y. Factors influencing the adoption of renewable energy in the U.S. residential sector: An optimal parameters-based geographical detector approach. *Renew. Energy* **2022**, *201*, 450–461. [CrossRef]
36. Wang, J.F.; Li, X.H.; Christakos, G.; Liao, Y.L.; Zhang, T.; Gu, X.; Zheng, X.Y. Geographical Detectors-Based Health Risk Assessment and its Application in the Neural Tube Defects Study of the Heshun Region, China. *Int. J. Geogr. Inf. Sci.* **2010**, *24*, 107–127. [CrossRef]
37. Wren, C. Geographic concentration and the temporal scope of agglomeration economies: An index decomposition. *Reg. Sci. Urban Econ.* **2012**, *42*, 681–690. [CrossRef]
38. Wang, X.; Zhang, J.; Cenci, J.; Becue, V. Spatial Distribution Characteristics and Influencing Factors of the World Architectural Heritage. *Heritage* **2021**, *4*, 2942–2959. [CrossRef]
39. Zhang, S. A study on traditional villages as a form of human settlement and their integrated conservation. *Urban Plan* **2017**, *2*, 44–49. (In Chinese) [CrossRef]
40. Zhang, J.; Zhu, W.; Zhu, L.; Cui, Y.; He, S.; Ren, H. Topographical relief characteristics and its impact on population and economy: A case study of the mountainous area in western Henan, China. *J. Geogr. Sci.* **2019**, *29*, 598–612. [CrossRef]
41. Ye, D. The interactive mechanism of man-earth areal system and the sustainable development. *Geogr. Res.* **2001**, *20*, 307–314. (In Chinese)
42. Wang, F.; Gao, C. Settlement–river relationship and locality of river-related built environment. *Indoor Built Environ.* **2020**, *29*, 1331–1335. [CrossRef]
43. Fujita, M. *Spatial Economics*; Edward Elgar Publishing: Northampton, MA, USA, 2005.
44. Yeung, H.W.-c. Rethinking relational economic geography. *Trans. Inst. Br. Geogr.* **2005**, *30*, 37–51. [CrossRef]
45. Jiao, S.; Zheng, Z.; Xu, F. The marginal tendency of the traditional village distribution: The case study of Hunan Province. *Geogr. Res.* **2016**, *35*, 1525–1534.

46. Ha, G.; Yafang, Y.; Zeng, Z. Study on the Influence of Mutual Adaptation between National Park and Traditional Village Planning—Loushang Ancient Village Scenic Spot in Guizhou Province as the Example. *Chin. Landsc. Archit.* **2020**, *36*, 89–94. (In Chinese) [CrossRef]
47. Zhao, Y.; Tian, Y. Research on the Spatial Distribution Characteristics and Influencing Factors of Traditional Villages in Southwest China. *Dev. Small Cities Towns* **2020**, *38*, 54–62. (In Chinese) [CrossRef]
48. Nicholson-Smith, D. *The Production of Space*; Blackwell Publishers Limited: Oxford, UK, 1991.
49. Harvey, D. *Marx, Capital, and the Madness of Economic Reason*; Oxford University Press: Oxford, UK, 2017.
50. Hu, J.; Zhang, C.; Sun, C.; Zheng, W. Distribution pattern of national traditional villages in Guilin from the perspective of space production. *J. Guilin Univ. Technol.* **2021**, *36*, 23–32. (In Chinese)
51. Ng, Y.-K. *Welfare Economics*; Springer: Berlin/Heidelberg, Germany, 1983.
52. Su, H.; Wang, Y.; Zhang, Z.; Dong, W. Characteristics and Influencing Factors of Traditional Village Distribution in China. *Land* **2022**, *11*, 1631. [CrossRef]