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Spatiotemporal Characteristics of Rural Restructuring Evolution and Driving Forces in Mountainous and Hilly Areas

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Abstract: Rural restructuring is an effective means to boost rural revitalization. Research on rural restructuring and its driving forces is helpful to adjust the evolution direction of key development factors, and form a coupling and coordinated development pattern. Taking Chongqing as an example, this paper adopts basic geographic data, land use data, and social and economic data, and uses the entropy method, spatial econometric model, and GTWR model. The paper explores the spatiotemporal evolution pattern of influencing factors on rural restructuring from 2000 to 2018 from the perspective of exogenous driving and endogenous driving. The results show the following. (1) During the study period, the average values of the rural economic restructuring intensity index, social restructuring intensity index, spatial restructuring intensity index, and comprehensive restructuring intensity index were 0.138, 0.118, 0.123, and 0.379, respectively. During the research period, rural restructuring in Chongqing experienced four development stages: space-economic restructuring-led, economic-social restructuring-led, economic restructuring-led, and social-spatial restructuring-led. In general, the dominant speed of economic restructuring gradually accelerated, and the changes in spatial restructuring were obvious but still lagging. Compared with other periods, the characteristics of social restructuring and spatial restructuring were more obvious between 2015 and 2018. (2) Different types of rural restructuring were affected by exogenous and endogenous factors. Exogenous driving mainly showed a negative impact on the changes in rural restructuring in the study area, while endogenous driving mainly showed a positive impact. (3) The driving system composed of exogenous driving and endogenous driving showed obvious timing and dynamic fluctuation. From 2000 to 2005 and from 2015 to 2018, rural restructuring in the study area was balanced and driven by endogenous and exogenous factors. From 2005 to 2015, rural restructuring in the study area was dominated by exogenous driving. Based on the influence differences and internal correlations of the driving forces of rural restructuring, policy opinions are put forward from the two aspects of restructuring path and restructuring guarantee, which provide a scientific basis for the determination of rural development direction and path selection.

Keywords: rural restructuring; exogenous driving; endogenous driving; spatiotemporal features; Chongqing

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1. Introduction

Rural development research has always been the focus of human geography and rural geography [1]. Since the end of World War II, in the process of rapid urbanization and industrialization, the social and economic development environment and the combination of factors in rural areas have undergone profound changes, whether in developed countries in Europe and America or developing countries in Asia and Africa [2]. Since the middle of

the 20th century, the rural space in developed western countries has undergone significant changes and restructurings in terms of society, culture, economy, and ecology. In the 1990s, China entered a critical period of urban-rural development transformation and land use transformation. The transformation of the rural area system and the continuous coupling development of the human-earth system [3], the restructuring of different dimensions, and the restructuring of multiple dimensions show an evolutionary form of interaction and replacement [4]. Against the background of rural revitalization, the direction of rural development guides the changes made to rural development paths; the choice of rural development path breeds the formation of the rural restructuring mode; the evolution of rural restructuring affects the development of the rural regional system [5].

Since the beginning of the 21st century, with the advancement of industrialization, informatization, urbanization, and agricultural modernization, the endogenous and exogenous development factors of the rural regional system have been deconstructed and restructured, and the level of rural development has changed. Urban transformation, counterurbanization, and rural industrialization have further spawned the demand for rural restructuring [6], and rural restructuring has attracted the wide attention of scholars. Rural restructuring is a process of social, economic, and spatial reshaping in rural areas under the interaction of factors such as urban–rural population flow, changes in the proportion of agricultural service industries in the rural industrial structure, and the differentiation and reorganization of social and economic development factors [7]. Rural restructuring affects the material and non-material elements of rural development through optimal allocation and effective management, to cope with the external regulation of the countryside and meet the needs of internal development. The social and economic form of the countryside has been reshaped, the regional spatial pattern has been optimized, and the rural regional system has achieved sound development [8]. The content of restructuring includes three complementary and mutually restrictive dimensions: rural economic restructuring, social restructuring, and spatial restructuring [9]. Economic restructuring reshapes the new driving force of rural economic development, achieves rural internal vitality, and increases the value of external output [10]. Social restructuring reshapes the rural governance structure and further improves the rural governance system [11]. Spatial restructuring is the process of optimizing the rural spatial system, reshaping the spatial pattern of rural production, life, and ecology, and realizing the optimization, adjustment, and even fundamental change of rural regional space [12]. Rural restructuring is the process of rural transformation and development. By measuring the evolution of long-term rural restructuring, it is found that rural economic restructuring is the main type of rural restructuring at present. Changes in economic conditions have an impact on the restructuring of local social relations [13]. With the flow of population, capital and technology enter the countryside, stimulating the restructuring of a rural economic model and changes to social space, and accelerating the restructuring of rural space [14]. The complete rural restructuring process is divided into four stages according to the evolution of the time sequence: the initial stage, the development stage, the stabilization stage, and the stable stage [15]. In addition, the current research also discusses the coupling relationship of economic restructuring, social restructuring, and spatial restructuring in typical regions. According to the restructuring type and development stage, the restructuring mechanism of element integration, structure reorganization, and function optimization of the rural regional system have been proposed [16].

In addition, the development and evolution of rural areas have their laws and are also affected by external forces such as capital and major projects [17]. At present, there is a consistent conclusion that the influencing factors on rural development have experienced a transformation process from single factor to multifactor integration. The influencing factors include exogenous factors such as urbanization, industrialization, and marketization [18], and endogenous factors such as resource environment and location conditions [19]. Under the influence of the continuous advancement of industrialization and urbanization, the transformation of urban and rural social economies, and the increasing openness of rural areas, the effect of natural factors on the evolution of rural

development has weakened, and the effect of humanistic social and economic factors on rural development and change has been increasing [20,21]. For example, the entry of social capital can enhance the vitality of rural development [22], and the development of some villages requires further increased government support and intervention [23]. The study further extends to the comprehensive impact of social and economic factors such as natural environment and population, transportation, infrastructure, and human decision making on rural development [24]. Shcherbina and Gorbenkova [25] evaluate rural sustainable development based on the three factors of social economy, spatial development, and ecological environment. Hedlund and Lundholm [26] construct the 'rural development index' based on the sustainable development model, and apply it to the study of rural settlement development. Forleo et al. [27] built a multi-dimensional system of population drivers, sociocultural drivers, agriculture, animal husbandry, and tourism, economic drivers, and natural drivers, and Gorbenkova et al. [28] explored five important incentive drivers that include human behaviors, social systems, economic systems, environmental systems, and administrative systems. With the continuous and in-depth development of globalization, the phenomenon of the 'rural gentry' began to appear in the suburbs of individual megacities [29]. Globalization has also continued to penetrate individual rural areas with advantageous locations, and its impact on rural restructuring has gradually become prominent [30]. Research on its impact has attracted further attention from scholars. At the same time, against the background of rapid urbanization, the empirical research on rural restructuring zoning and influencing factors in different regions of China mainly focuses on the following three types of regions: the eastern coastal developed areas driven by industrialization and urbanization [31–33], the typical central agricultural areas driven by agricultural specialization [34,35], and the marginal villages of metropolises driven by markets and consumption [36,37]. These areas have the characteristics of a developed economy, agricultural development advantages, and are close to large cities that take the lead in the transformation and restructuring processes, with industry nurturing agriculture and urban areas nurturing rural areas, which has become a popular area for scholars to study [38].

Overall, the research on rural restructuring at home and abroad focuses on the connotation and on the framework of restructuring, restructuring type, restructuring path, restructuring mechanism, driving mechanism, spatial differentiation characteristics, and influencing factors. The scientific content is more comprehensive, and the quantitative measurement of rural development is more systematic. However, it mainly carries out the quantitative measurement of a long-term sequence of rural restructuring, mainly adopts the qualitative judgment on the factors affecting rural restructuring, and has less quantitative and comprehensive judgment on the influencing factors of a long-term sequence of rural restructuring. In addition, the realization path of rural restructuring is to realize the integration of elements, structural reorganization, and functional optimization of a rural regional system from the three aspects of rural space restructuring, economic restructuring, and social restructuring, aiming at the prominent problems of rural spatial form such as dispersion, disorder, pollution, economic form, and social form. However, there are great differences in the characteristics, structure, human–land interaction mode, and interaction effect of the regional system of the human–land relationship in different regions. The rural development characteristics and evolution dynamics of the northern plains and the southern hills and mountains are different. According to the data from China County Statistical Yearbook (county–city volume) in 2014 and 2017, there are about 2079 mountainous counties, plain counties, and hilly counties in China (excluding some municipal districts), of which the number of mountainous counties accounts for 43.05% and the number of hilly counties accounts for 25.69%. As an important part of China's land, mountainous and hilly areas are affected by the special natural geographical environment and human environment. Compared with plain areas, its level of economic and social development has a long-term lag [39]. The spatial distribution and evolution of mountainous and hilly areas have the characteristics of low concentration, rapid decline, and complex and diverse

types. They play an important role in China's modernization process and are also a difficult area in China's rural revitalization [40]. At the same time, the rural regional system in mountainous and hilly areas is a complex and giant system [41]. With the rapid development of industrialization and urbanization, its spatial evolution and restructuring are more susceptible to exogenous factors [42], and the relationship between rural people and the land has undergone profound changes [43]. It is crucial to conduct further research on the spatial heterogeneity and evolution, driving factors, and mechanisms of rural restructuring in mountainous and hilly areas.

2. Materials and Methods

2.1. Study Area and Data Sources

Located in southwest China, Chongqing is the western international comprehensive transportation hub and international gateway hub. The geographical coordinates are between 105°11′–110°11′ E and 28°10′–32°13′ N. The total land area of the city is 82,400 km^2, with 38 districts and counties under its jurisdiction, but due to the urbanization rate of Yuzhong District being 100% and the rural household registration population in Dadukou District being zero in 2018, these districts were eliminated from this study. Wansheng District and Shuangqiao District were revoked and merged in 2011. To facilitate comparison, before 2011, Wansheng District was unified with Qijiang District, and Shuangqiao District was unified with Dazu District. As the only municipality directly under the central government in the west and the central city in the west of China, Chongqing's social and economic development is rapid. By 2020, the permanent population is 3.209 million, the urbanization rate is 69.46%, the per capita arable land is 0.87 mu (0.06 hm^2), the per capita GDP is 77,900 (calculated by the permanent population), and the per capita disposable income of permanent residents who are farmers is 16,400. The landforms in the region are mainly mountainous and hilly. The mountainous area accounts for 76%, the hilly area accounts for 22%, the plain dam accounts for only 2%, and the elevation difference is 2723.7 m. The overall terrain features are high in the southeast and northeast, low in the middle and west, and gradually decreasing from north to south in the Yangtze River valley. It is a typical mountainous and hilly area in China (Figure 1).

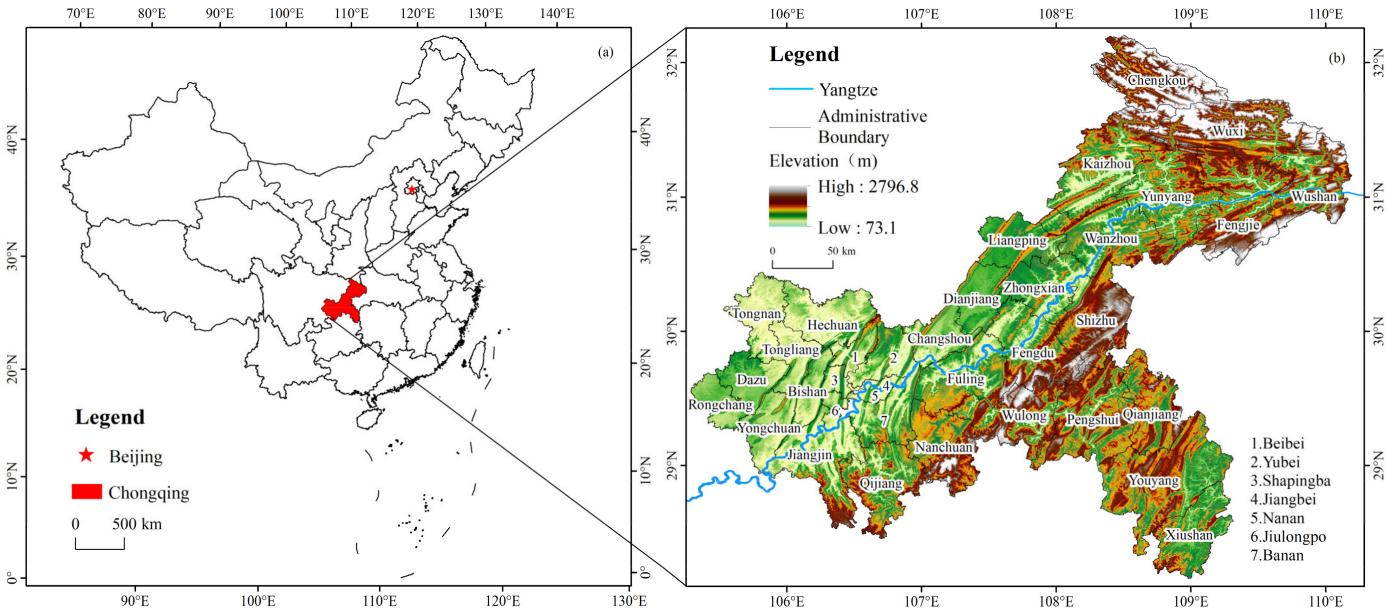

Figure 1. The study area: (**a**) the location of Chongqing in China; (**b**) the administrative divisions and elevation distribution of Chongqing.

The reasons for choosing Chongqing as the study area of rural restructuring are as follows. First, Chongqing is a municipality directly under the central government that

integrates large cities, large rural areas, large mountainous areas, and large reservoir areas. Regional differences in social and economic development are obvious. In particular, a large number of rural settlements have disappeared in 22 districts and counties in the region due to the influence of the implementation of the Three Gorges Project. The newly built settlements are resettled in the regions with higher altitudes, which profoundly changes the regional system of the human-land relationship. Second, the development types of new rural industries and new formats are diverse, mainly including rural tourism homestays, farmhouses, and pastoral complexes. Among them, 'Bayu homestay' is a typical industry of rural industry extension and farmers' livelihood transformation, which effectively promotes the transformation of rural development. Third, the terrain and landform types of Chongqing are complex and diverse. The main urban area is dominated by low mountains and hills. The urban groups of the Three Gorges Reservoir area in northeast Chongqing and the Wuling Mountain range in southeast Chongqing are dominated by mountains, which is conducive to better exploring the spatial characteristics of the restructuring and evolution of rural areas with different landforms in the region.

The data required in this paper mainly include basic geographic data, land use data, and socioeconomic data. The study is limited by the lack of some index data before 2000, which it is impossible to query. After 2018, the statistical caliber of some data has changed, and the index data are difficult to unify. Therefore, the research period is from 2000 to 2018. Among them, the basic geographic data come from the Resource and Environmental Science and Data Center of the Chinese Academy of Sciences; the land use data come from the land change survey data of the Chongqing Municipal Bureau of Planning and Natural Resources; the socioeconomic data come from the 2019, 2016, 2011, 2006, 2001 Statistical Yearbooks of Chongqing, the Survey Yearbook of Chongqing, the Statistical Yearbooks of all districts and counties, and the Statistical Bulletin of National Economic and Social Development.

2.2. Research Idea

Under the guidance of rural restructuring theory and rural regional system theory, this paper uses basic geographic data, land use data, and socioeconomic data to study rural regional space at the county scale. The changes in rural economic development, social development, and spatial utilization level, combined with the entropy method, were used to measure the intensity index of rural economic restructuring, the social restructuring intensity index, and the spatial restructuring intensity index, and the process of rural restructuring in the study area from 2000 to 2018 was quantitatively evaluated. In the context of the regional development of industrialization, globalization, urbanization, and marketization, the factors influencing rural restructuring were studied based on the changes in the external environment and the internal conditions of the system. The spatial autocorrelation test, the spatial econometric model, and the GTWR (spatiotemporal geographically weighted regression) model were used to analyze the spatiotemporal differentiation characteristics, with the restructuring strategy and feasible path proposed according to local conditions (Figure 2).

2.3. Methods

2.3.1. Calculation of Rural Restructuring Intensity Index

Rural restructuring is a positive qualitative change process of a rural regional system relative to a certain time node or a transformation and development process formed by quantitative change accumulation [37]. In essence, rural restructuring refers to the changes in the internal factor organization and its structural relationship that occur in the rural regional system in response to exogenous driving, such as industrialization, urbanization, and globalization under the condition of a market economy, which are manifested as economic restructuring, social restructuring, and spatial restructuring. Its geographical effect is manifested as the changes in the relationship between rural people and the land [44]. The rural restructuring intensity index is the quantification of whether the rural area has been reconstructed, and of its positive evolution degree in a certain

period. It can be obtained by comparing the rural development status at the end and the beginning of the study period. To better distinguish the rural restructuring intensity index from the restructuring intensity index of each sub-dimension, the rural comprehensive restructuring intensity index (RRI (c)) is used to represent the rural restructuring intensity index in the following. The economic restructuring intensity index (RRI (e)) represents the measurement of the change of economic production factors within the rural regional system, the social restructuring intensity index (RRI (so)) represents the measurement of the change of social living factors, and the spatial restructuring intensity index (RRI (sp)) represents the measurement of the change of natural human geography factors [45]. Therefore, the research unit was reconstructed based on the rural development level at the end of the comparative study (T_2) and the beginning of the study (T_1). On this basis, the evaluation index system of the level of rural development was constructed from three dimensions: economy, society, and space (Table 1). The construction of the index system follows the principles of data availability, representativeness, and consistency of statistical caliber. Referring to the research results of Yuheng Li [46], Michael Woods [47], Ren Yang et al. [48], Anita Morzillo et al. [49], and Hannah Gosnell [50], four indicators, including the GDP of the primary industry, industrial structure, the number of rural employees, and the income level of farmers, were selected to reflect the development and change of the rural economy. Medical and health conditions, power facilities, and road network density were selected to reflect rural living standards and their changes; three indicators, namely, rural residential land use efficiency, cultivated land use efficiency, and land use efficiency of secondary and tertiary industries, were selected to characterize the change in rural spatial structure.

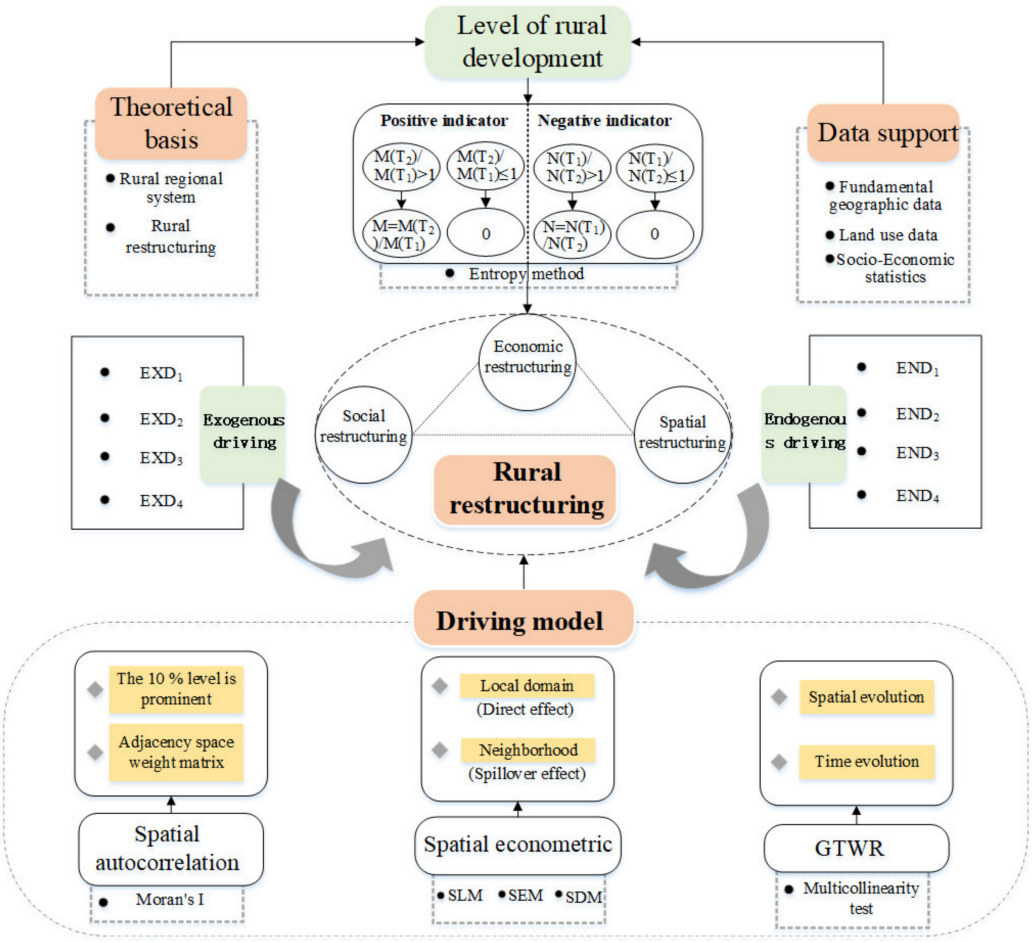

Figure 2. Research thinking diagram.

Table 1. Evaluation index system of rural development level.

First-Grade Index	Second Index	Quantification Method	Direction
Economic development	The GDP of the primary industry	GDP of the primary industry	+
	Industrial structure	Value added of secondary and tertiary industries/GDP	+
	The number of rural employees	The number of rural employees	+
	The income level of farmers	Per capita net income of farmers	+
Social development	Medical and health conditions	Number of beds in medical institutions/Total population of the region	+
	Power facilities	Rural electricity consumption/Total rural population	+
	Road network density	Highway mileage/Land area	+
Space utilization	Rural residential land use efficiency	Rural residential area/Total rural population	−
	Cultivated land use efficiency	Grain yield/Cultivated land area	+
	Land use efficiency of secondary and tertiary industries	Value added of secondary and tertiary industries/(Urban construction land, industrial and mining transportation, and other construction lands)	+

'+' means moderate positive index; '−' represents a moderate negative indicator.

Based on the research results of Hualou Long and Yansu Liu [51], and Lucy Zheng et al. [52], the change in the four indicators representing economic development reflects the intensity of economic restructuring of the research unit; the change in three indicators representing the level of social development represents the intensity of social restructuring, and the change in three indicators representing the level of spatial utilization measures the intensity of spatial restructuring. Based on the research results of Shuangshuang Tu et al. [16], the original data of the rural restructuring index were processed. For the positive indicator M in Table 1, if M (T_2)/M (T_1) > 1, the factor may be reconstructed, and the reconstruction intensity index is calculated according to its ratio. If M (T_2)/M (T_1) $\leq$ 1, the element has not been reconstructed, and the reconstructed strength index is calculated by counting the index value as 0. If N (T_1)/N (T_2) > 1, the factor may be reconstructed, and the reconstructed strength index is calculated according to its ratio. If N (T_1)/N (T_2) $\leq$ 1, the element has not been reconstructed, and the reconstructed strength index is calculated by counting the index value as 0. The rural restructuring model was established as follows.

(1) Evaluation index empowerment. To eliminate the influence of the original data dimension of the evaluation index system in the evaluation, the original data were normalized by the extreme value method. Index weighting uses the entropy method. The evaluation idea is that the greater the difference between the values of the evaluation object in a certain index, the more important the object is, and the greater the weight value is. Taking into account the timing characteristics and overall performance of the indicators, the average weights of the four time periods of 2000–2005, 2005–2010, 2010–2015, and 2015–2018 were selected as the final weights for each dimension of economic restructuring, social restructuring, and spatial restructuring. Finally, combined with the index weight and standardized value, the weighted summation method was used to calculate the RRI (e), RRI (so), RRI (sp) and RRI (c) of the rural areas in each county.

If Z_{ij} is a positive indicator:

$$Z_{ij} = \frac{X_{ij} - minX_{ij}}{maxX_{ij} - minX_{ij}} \quad (1)$$

If Z_{ij} is a negative indicator:

$$Z_{ij} = \frac{maxX_{ij} - X_{ij}}{maxX_{ij} - minX_{ij}} \quad (2)$$

In the formula, Z_{ij} represents the normalized value of indicator j in region i; X_{ij} represents the actual value of indicator j in region i; and $minX_{ij}$ and $maxX_{ij}$ are the minimum and maximum values of item j in region i, respectively.

Calculation of integrated standardized values P_{ij}:

$$P_{ij} = \frac{Z_{ij}}{\sum Z_{ij}} \tag{3}$$

Calculation of entropy e_j for indicator j (n is the number of elements, $k = \frac{1}{\ln n}$):

$$e_j = -k \sum P_{ij} \ln P_{ij} \tag{4}$$

Calculate the j index difference coefficient g_i:

$$g_i = 1 - e_j \tag{5}$$

Calculate the weight of indicator j, w_j:

$$w_j = \frac{g_i}{\sum g_i} \tag{6}$$

Calculation of final weights $\overline{w_j}$:

$$\overline{w_j} = \frac{w_{j1} + w_{j2} + w_{j3} + w_{j4}}{4} \tag{7}$$

In the formula, $\overline{w_j}$ is the average weight of the indicator j of the rural restructuring index; w_{j1} is the 2000–2005 weight; w_{j2} is the 2005–2010 weight; w_{j3} is the 2010–2015 weight; and w_{j4} is the 2015–2018 weight.

(2) Evaluation of restructuring index. Combined with the index weight and standardized value, the weighted summation method was used to calculate the $RRI_{(e)i}$, the $RRI_{(so)i}$, and the $RRI_{(sp)i}$ of the rural regional system of each research unit. The specific formula is as follows:

$$RRI_{(e)i} = \sum_{j=1}^{m} Z_{ij}\overline{w_j},\ RRI_{(so)i} = \sum_{j=1}^{m} Z_{ij}\overline{w_j},\ RRI_{(sp)i} = \sum_{j=1}^{m} Z_{ij}\overline{w_j} \tag{8}$$

In the formula, $RRI_{(e)i}$, $RRI_{(so)i}$, and $RRI_{(sp)i}$ is the $RRI_{(e)}$, the $RRI_{(so)}$, and the $RRI_{(sp)}$ of the rural regional system of region i.

(3) Evaluation of $RRI_{(c)i}$. Referring to the existing research results [50], based on the connotation deconstruction of rural restructuring, this paper quantitatively evaluates rural restructuring, and the specific formula is as follows:

$$RRI_{(c)i} = \frac{[RRI_{(e)i} + RRI_{(so)i} + RRI_{(sp)i}]}{3} \tag{9}$$

In the formula. $RRI_{(c)i}$ is the rural comprehensive restructuring index of region i.

2.3.2. Evaluation Index Selection of the Driving Force of Rural Restructuring

The development of urbanization and industrialization forms the dilemma of rural development marginalization, and globalization further brings profound changes to rural development. Facing the challenges of the external development environment, it is necessary to respond to the needs of rural internal development. Guiding and activating the positive effect of urbanization, industrialization, and globalization on rural development is a prerequisite for rural revitalization, and tapping the potential and vitality of rural development is a key link in rural revitalization. Drawing on the research results of Hualou Long et al. [53], Yurui Li et al. [54], Lynda Cheshire et al. [55], and Sarah Johnsen [56], this

paper interprets the rural restructuring mechanism based on the changes in the internal and external environment of the system, which can be divided into two first-level types from the perspective of the power source of restructuring: the exogenous driving of the influence of industrialization, urbanization, and globalization, and the endogenous driving of rural self-development in response to the changes in the external environment [57]. The positive effect of the external environment on rural development is mainly manifested in the changes in the scale of the agricultural market, agricultural technology conditions, agricultural market conditions, and agricultural input structure. In response to changes in the external environment, rural regional development mainly reflects changes in the per capita arable land area, the agricultural equipment level, the rural market level, and the agricultural market structure. Four indicators were selected: the proportion of industrial output (EXD_1), the per capita urban construction land area (EXD_2), the proportion of the urban population (EXD_3), and the total value of imports and exports (EXD_4). The intrinsic driving selection of the proportion of the agriculture, forestry, animal husbandry, and fishery service industries (END_1), the rural employment non-agricultural rate (END_2), the per capita arable land in rural areas (END_3), and the average agricultural machinery power (END_4) are the four endogenous driving indicators. Driven by internal and external sources, the response changes in the system element organization and structure relationship were analyzed (Table 2).

Table 2. Evaluation index system of the driving forces of rural restructuring.

First-Grade Index	Second Index	Quantification Method
Exogenous driving	The proportion of industrial output	Industrial output value/GDP
	Per capita urban construction land area	Urban construction land area/Urban populations
	The proportion of the urban population	Urban population/Total population of the region
	The total value of imports and exports	The total value of imports and exports
Endogenous driving	The proportion of the agriculture, forestry, animal husbandry, and fishery service industries	The output value of the agriculture, forestry, animal husbandry, and fishery service industries/The output value of the agriculture, forestry, animal husbandry, and fishery service industries
	Rural employment non-agricultural rate	(The number of rural employees—Agriculture, forestry, animal husbandry, and fishery practitioners)/The number of rural employees
	Per capita arable land in rural areas	Cultivated land area/Permanent population in rural areas
	Average agricultural machinery power	Total power of agricultural machinery/Cultivated land area

2.3.3. Model Selection of Driving Force Analysis

1. Spatial autocorrelation test

Moran's I is used for the spatial autocorrelation test of the research object, and the formula is as follows:

$$\text{Moran's I} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}\left(Y_i - \overline{Y}\right)\left(Y_j - \overline{Y}\right)}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}} \quad (10)$$

$$S^2 = \left(Y_i - \overline{Y}\right)^2 / n \quad (11)$$

In the formula, Y_i and Y_j are the rural restructuring intensity indices of counties i and j, respectively; $\overline{Y}$ is the average value of the rural restructuring intensity index in the research area; W_{ij} is the spatial weight matrix between spatial units i and j. This paper adopts the adjacency spatial weight matrix, and the spatial weight adopts the queen adjacency. The range of Moran's I is between -1 and 1, which is greater than 0 and closer to 1, indicating that there is a positive spatial correlation between the study object and vice versa. Moran's I was used to analyze the spatial correlation of the comprehensive index of rural restructuring

and the restructuring index of each dimension in Chongqing from 2000 to 2018. The value of Moran's I is significantly positive at the level of 10% aboriginality, indicating that the distribution of rural restructuring has obvious spatial agglomeration.

2. Spatial econometric model

It is difficult for contemporary geography to focus on space from its elements, functions, and various human activities, and it is also difficult to ignore the impact of human-centered social and economic processes on space. A relatively dynamic and linked perspective is needed to conduct a comprehensive investigation [58]. Based on the existing research results [59–61], the spatial durbin model (SDM) was introduced to analyze the spatial effect of the driving force on rural restructuring intensity and its decomposition index. The model is set as follows:

$$F_{it} = \rho \sum_{j=1}^{n} W_{ij} F_{jt} + \beta X_{it} + \varepsilon_{it} \quad (12)$$

$$\varepsilon_{it} = \lambda \sum_{j=1}^{n} W_{ij} \varepsilon_{jt} + \mu_{it} \quad (13)$$

$$F_{it} = \rho \sum_{j=1}^{n} W_{ij} F_{jt} + \beta X_{it} + \theta \sum_{j=1}^{n} W_{ij} X_{jt} + \mu_{it} \quad (14)$$

In the formula, F_{it} represents the rural restructuring intensity index of period t in area i; X_{it} represents the independent variable vector of period t in region i; ρ and λ are the spatial lag coefficient and the spatial error coefficient, respectively; W_{ij} is the spatial weight matrix; β is the influence coefficient; X_{it} is the influencing factor of rural restructuring; and ε_{it} is a random perturbation term. When $\rho = 0$, the model is a spatial error model; when $\lambda = 1$, the model is a spatial lag model. When $\rho \neq 0$ and $\lambda = 0$, Formula (1) is a spatial Durbin model (Formula (14)), and θ denotes the spatial spillover effect.

Based on Stata16 software, the model was selected and the spatial effect was analyzed by using the spatial econometric model. When measuring the spatial effect of driving force on rural economic reconstruction, the Wald test was performed on SAR, chi2 (8) = 22.09, Prob > chi2 = 0.0047, and the Wald test was performed on SEM, chi2 (8) = 20.12, Prob > chi2 = 0.0099. When measuring the spatial effect of driving force on rural social reconstruction, the Wald test was performed on SAR, chi2 (8) = 23.49, Prob > chi2 = 0.0028, and the Wald test was performed on SEM, chi2 (8) = 26.28, Prob > chi2 = 0.0009. When measuring the spatial effect of driving force on rural spatial reconstruction, the Wald test was performed on SAR, chi2 (8) = 45.06, Prob > chi2 = 0.0000, and the Wald test was performed on SEM, chi2 (8) = 49.56, Prob > chi2 = 0.0000. When measuring the spatial effect of driving force on rural reconstruction, the Wald test was performed on SAR, chi2 (8) = 27.78, Prob > chi2 = 0.0005, and the Wald test was performed on SEM, chi2 (8) = 27.09, Prob > chi2 = 0.0007. The results all show that the assumption that the model can be simplified is rejected, that is, SDM is the optimal model in this paper. Therefore, multivariate statistical analysis was used to identify the influencing factors, and multiple structure analysis was used to deduce the restructuring mechanism. Taking economic restructuring, social restructuring, and spatial restructuring as the explained variables and each driving force as the explanatory variable, SDM was used to analyze the comprehensive spatial correlation of the influence of each driving force on the restructuring of the evaluation unit and adjacent evaluation units during the research period.

3. GTWR model

There are spatiotemporal differences in the impact of driving forces on rural restructuring in different periods. Considering only the influence of spatial heterogeneity and ignoring the nonequilibrium of the time dimension is not conducive to the in-depth exploration of the characteristics and laws of the driving forces of spatial and temporal differentiation of rural restructuring in the study area. By using ArcGIS10.2 and introduc-

ing the GTWR model, the temporal and spatial characteristics were combined to explore further the temporal and spatial nonstationarity of rural restructuring in the study area, and measure the evolution of the temporal and spatial influence of driving forces on rural restructuring. As an extension of the GWR model, the GTWR model introduces the time dimension compared with the traditional geographically weighted regression model. The model can be used to diagnose the spatiotemporal nonstationarity of things or phenomena [62]. Its formula is as follows:

$$Y_i = \beta_0(u_i, v_i, t_i) + \sum \beta_k(u_i, v_i, t_i) X_{ik} + \varepsilon_i (i = 1, 2, 3, \cdots n) \quad (15)$$

In the formula, Y_i is the explanatory variable of the ith space element, n is the number of space elements, k is the number of explanatory variables for space element i, t_i is the time coordinates of the ith space element, $\beta_0(u_i, v_i, t_i)$ denotes the space–time intercept term of space unit i, X_{ik} represents the kth explanatory variable value of space unit i, $\beta_k(u_i, v_i, t_i)$ denotes the regression coefficient of the kth explanatory variable of space element i and is a function of space–time coordinates, and ε_i is the error term. Since the multiple collinearities between variables lead to incorrect regression results, collinearity between explanatory factors was tested, and the results show that the variance expansion coefficients between factors are less than 10, which proves that there are no multiple collinearities between explanatory variables, and they can therefore be used for regression analysis.

3. Results

3.1. Characteristics of Rural Restructuring Stage

The change in the rural restructuring intensity index in the study area from 2000 to 2018 has nonlinear characteristics. The average comprehensive restructuring intensity index of the four research periods is 0.471, 0.388, 0.292, and 0.365, respectively, showing a trend of gradually decreasing and then increasing. The restructuring dimensions dominated by each period show diversified characteristics. From 2000 to 2005, RRI (sp) contributed almost 49% to RRI (c), RRI (e) contributed 32.6% to RRI (c), and RRI (sp) > RRI (e) > RRI (so). This stage of development was dominated by spatioeconomic restructuring. From 2005 to 2010, RRI (e) contributed nearly 45% to RRI (c), RRI (so) contributed 33.3% to RRI (c), and RRI (e) > RRI (so) > RRI (sp). This stage of development was dominated by economic-social restructuring. From 2010 to 2015, RRI (e) contributed up to 53% to RRI (c), RRI (e) > RRI (so) > RRI (sp), and this stage of development was dominated by economic restructuring. From 2015 to 2018, RRI (so) contributed nearly 48% to RRI (c), and RRI (sp) contributed nearly 32.7% to RRI (c), and RRI (so) > RRI (sp) > RRI (e), hence this stage was dominated by social-spatial restructuring (Table 3).

Table 3. The mean value evolution of the rural restructuring intensity index in different dimensions.

Period	RRI(e)	RRI(so)	RRI(sp)	RRI(c)
2000–2005	0.153	0.087	0.230	0.471
2005–2010	0.174	0.129	0.085	0.388
2010–2015	0.156	0.079	0.057	0.292
2015–2018	0.071	0.175	0.119	0.365
2000–2018	0.138	0.118	0.123	0.379

3.2. Spatial Characteristics of Rural Restructuring

The interval division of restructuring types of each dimension takes the mean of the study area and ±1 standard deviation of each index as the critical value and uses (0, mean −1 standard deviation), (mean −1 standard deviation, mean), (mean, mean +1 standard deviation), and (mean +1 standard deviation, 1) for mapping. It was determined that (0, mean −1 standard deviation) was the low-value area and (mean +1 standard deviation, 1) was the high-value area. Based on the analysis of the pattern characteristics of rural restructuring in the four research periods, it was found that the spatial difference

and spatial agglomeration of rural restructuring in different dimensions were significant. From 2000 to 2005, spatial restructuring dominated both in the whole study area and in the "one district and two groups" region. From 2005 to 2010 and from 2010 to 2015, economic restructuring was dominant. From 2015 to 2018, social restructuring was dominant. However, the absolute dominance of the restructuring of each dimension does not affect the multi-dimensional restructuring of rural areas, and the diverse composition is still obvious, with significant spatial differences in the distribution of high-value areas (Figure 3).

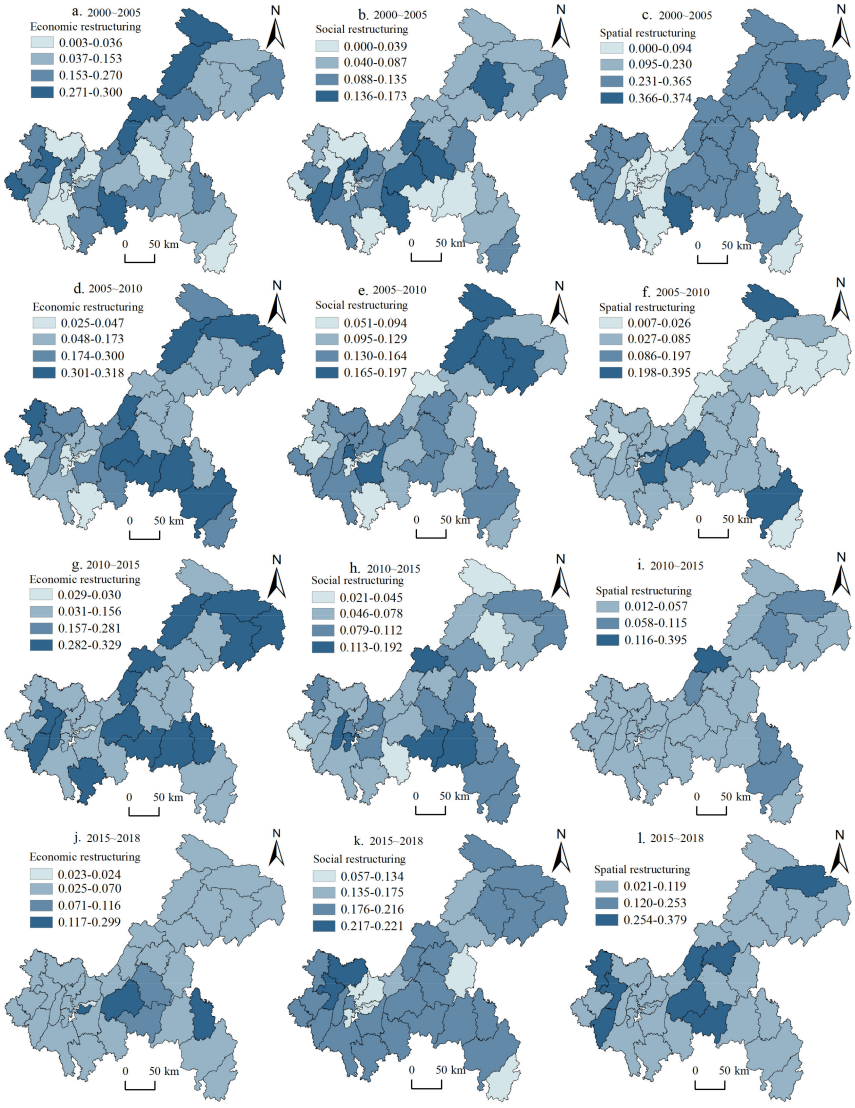

Figure 3. Spatial pattern of rural restructuring intensity in Chongqing.

3.2.1. Spatial Characteristics of Economic Restructuring

The mean values of the economic restructuring intensity index in the four research periods are 0.15, 0.17, 0.16, and 0.07, respectively. With evolution over time, the intensity of economic restructuring in the study area shows a decreasing trend. The high-intensity economic restructuring has gradually expanded from the urban group and the main urban area of the Three Gorges Reservoir area in northeast Chongqing to the urban group of the Wuling Mountain range in southeast Chongqing, and finally it presented a spatial distribution pattern of significant reduction. From 2000 to 2005, 50% of the county-level restructuring intensity was greater than the average, and the areas higher than the average were mainly distributed at the Sichuan-Chongqing junction and the Guizhou–Chongqing junction. From 2005 to 2010, the restructuring intensity of 50% of counties was greater than

the mean value, and the counties with values higher than the mean value gradually expanded into the urban group of the Wuling Mountain range in southeast Chongqing based on the above distribution pattern. From 2010 to 2015, 38.89% of the county restructuring intensity was greater than the average, the overall distribution pattern was consistent with the previous stage, and the restructuring intensity of some districts and counties changed. From 2015 to 2018, 13.89% of the county-level restructuring intensity was greater than the average, and the high-value area was significantly reduced (Figure 3).

3.2.2. Spatial Characteristics of Social Restructuring

The mean values of the social restructuring intensity index in the four research periods are 0.09, 0.13, 0.08, and 0.18, respectively. Over time, the intensity of social restructuring in the study area showed an increasing–decreasing–increasing trend. The high-intensity social restructuring shows the expansion from the main urban area to the Three Gorges Reservoir urban group in northeast Chongqing and the Wuling Mountain urban group in southeast Chongqing, and finally forms a relatively balanced global distribution model. From 2000 to 2005, 44.44% of the county restructuring intensity is greater than the mean value, and the areas above the mean value are mainly distributed in the central city and the 'one district, two groups' junction area of. From 2005 to 2010, 52.78% of the county restructuring intensity is greater than the average, which is higher than the average county distribution. From 2010 to 2015, 47.22% of the county restructuring intensity was greater than the average value. Compared with the previous two stages, the high-value area gradually moved to the southeast of the study area and was mainly distributed in the Three Gorges Reservoir urban group in northeast Chongqing and the Wuling Mountain urban group in southeast Chongqing. From 2015 to 2018, 72.22% of the county restructuring intensity was greater than the average. Compared with the previous three stages, the high-intensity restructuring situation in the study area was further strengthened, and the high-value areas were coordinated and distributed in the 'one district, two groups' area of Chongqing (Figure 3).

3.2.3. Spatial Characteristics of Spatial Restructuring

The mean values of the spatial restructuring intensity index in the four research periods are 0.23, 0.09, 0.06, and 0.12, respectively. With time, the intensity of spatial restructuring in the study area decreased and then increased. The high-intensity spatial restructuring shows that the global balanced distribution, except for the central urban area, is gradually concentrated in some districts and counties. From 2000 to 2005, 66.67% of the district and county restructuring intensity was greater than the mean value, and the areas above the mean value were mainly distributed in the urban groups of the Three Gorges Reservoir area in northeast Chongqing, the urban groups of the Wuling Mountain area in southeast Chongqing, and the districts and counties at the junction of Sichuan and Chongqing in the main urban area. From 2005 to 2010, 13.89% of the county-level restructuring intensity was greater than the average, and the restructuring situation was significantly weakened compared with the previous stage. From 2010 to 2015, 16.67% of the county-level restructuring intensity was greater than the average, and the high-value areas were mainly distributed in the urban groups of the Three Gorges Reservoir area in northeast Chongqing and the Wuling Mountain area in southeast Chongqing, showing the characteristics of small-scale agglomeration distribution and large-scale scattered distribution. From 2015 to 2018, 22.22% of the county restructuring intensity was greater than the average, and the high-value areas were scattered in each region (Figure 3).

3.3. Spatial Effect of the Driving Forces of Rural Restructuring

The spatial spillover effect of the SDM model is composed of direct effects and indirect effects to study the influence of independent variables on the rural restructuring of a county and surrounding counties. In general, exogenous driving hurts rural restructuring in the study area, while endogenous driving has a positive impact. The influence degree of exoge-

nous and endogenous driving is as follows: rural space restructuring > rural comprehensive restructuring > rural economic restructuring > rural social restructuring. In addition, rural comprehensive restructuring, economic restructuring, and social restructuring all have negative spatial spillover effects, while spatial restructuring shows positive spatial spillover effects (Table 4).

Table 4. Estimation of direct and indirect effects of the driving force.

Effect	Variate	RRI (c)	RRI (e)	RRI (so)	RRI (c)
Direct effects	EXD_1	0.047 (0.49)	0.100 ** (0.03)	−0.004 (0.81)	−0.052 (0.31)
	EXD_2	−0.262 ** (0.01)	−0.076 (0.26)	−0.026 (0.37)	0.104 (0.18)
	EXD_3	−0.009 (0.92)	−0.052 (0.39)	0.044 * (0.08)	0.082 (0.49)
	EXD_4	0.152 (0.19)	0.024 (0.74)	−0.02 (0.54)	0.334 *** (0.01)
	END_1	0.005 (0.96)	−0.014 (0.83)	0.025 (0.38)	−0.013 (0.88)
	END_2	0.134 * (0.09)	0.181 *** (0.00)	−0.029 (0.19)	−0.011 (0.86)
	END_3	0.183 ** (0.05)	0.101 * (0.08)	0.01 (0.67)	−0.187 (0.17)
	END_4	−0.091 (0.27)	0.003 (0.96)	−0.071 *** (0.00)	0.297 ** (0.01)
Indirect effects	EXD_1	0.019 (0.87)	−0.258 *** (0.00)	0.003 (0.94)	0.297 *** (0.01)
	EXD_2	0.155 (0.64)	0.382 * (0.08)	0.023 (0.85)	0.092 (0.70)
	EXD_3	−0.338 (0.17)	−0.386 ** (0.02)	0.203 ** (0.02)	0.169 (0.58)
	EXD_4	−0.210 (0.35)	−0.121 (0.37)	−0.190 ** (0.04)	0.505 *** (0.00)
	END_1	0.464 * (0.05)	0.099 (0.49)	0.054 (0.55)	0.163 (0.33)
	END_2	−0.238 (0.23)	0.124 (0.27)	−0.149** (0.05)	−0.451 *** (0.00)
	END_3	−0.385 ** (0.01)	−0.097 (0.30)	0.021 (0.68)	0.445 ** (0.01)
	END_4	−0.119 (0.65)	−0.099 (0.54)	−0.024 (0.80)	1.394 *** (0.01)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In exogenous driving, EXD_1 and EXD_3 have significant positive effects on rural economic restructuring, and EXD_2 and EXD_4 have significant negative effects on rural economic restructuring. For every 1% increase in the EXD_1 of a county, the rural economic restructuring of the county increased by 0.100%, the rural economic restructuring of the surrounding counties decreased by 0.258%, and the rural space restructuring of the surrounding counties increased by 0.297%. EXD_2 is significantly indigenous to the comprehensive rural restructuring at the 5% significance level, indicating that EXD_2 has a feedback effect. For every 1% increase in the EXD_2 of a county, the comprehensive rural restructuring of the county is reduced by 0.262%, but it has no significant influence on various types of rural restructuring and the rural restructuring of surrounding counties. For every 1% increase in EXD_3, the county's rural social restructuring increased by 0.044%, which had a significant negative impact on the rural economy of the surrounding counties and a significant positive effect on the social restructuring of the surrounding counties. For every 1% increase in EXD_4, the county's rural space restructuring receives a feedback increase of 0.334%, which has a significant positive impact on the rural space restructuring of the surrounding counties, but hurts the rural social restructuring of the surrounding counties.

In terms of endogenous driving, END_1 has no significant influence on the rural restructuring of the county, but every 1% increase has a 0.464% impact on the comprehensive rural restructuring of the surrounding counties. Each 1% increase in END_2 has a significantly positive impact on the rural comprehensive restructuring and rural economic restructuring of the county, increasing by 0.134% and 0.181%, respectively, and has a significantly negative impact on the rural social restructuring and rural spatial restructuring of the surrounding counties, reducing by 0.149% and 0.451%, respectively. END_3 has no significant influence on rural social restructuring and rural spatial restructuring in the county. END_4 has a significantly negative impact on the rural social restructuring of districts and counties, has a significantly indigenous impact on the rural spatial restructuring of districts and counties, and has a significantly indigenous impact on the rural spatial restructuring of surrounding counties.

3.4. Spatiotemporal Evolution of Driving Forces of Rural Restructuring

3.4.1. Time Evolution of the Driving Forces Affecting Strength

The exogenous driving factor of rural restructuring in each study period was EXD_2, and the contributions were 42.23%, 39.66%, 49.32%, and 58.87%, respectively. The endogenous driving factor was END_4, and the contributions were 57.08%, 62.71%, 57.38%, and 34.98%, respectively. The change in endogenous driving factors was more obvious than that in exogenous driving factors. With the evolution of time, the influence intensity of EXD_2 gradually increased, and the influence contribution increased from 42.23% to 58.87%. The influence intensity of EXD_3 and END_4 gradually decreased. The influence contribution of EXD_3 decreased from 36.24% to 11.56%, and the influence contribution of END_4 decreased from 57.08% to 34.98%. The influence intensity of its factors fluctuated. From 2000 to 2005, the influence of exogenous driving factors was $EXD_2 > EXD_3 > EXD_4 > EXD_1$, and the influence of endogenous driving factors was $END_4 > END_1 > END_3 > END_2$. From 2005 to 2010, the influence of exogenous driving factors was $EXD_2 > EXD_4 > EXD_3 > EXD_1$, and the influence of endogenous driving factors was $END_4 > END_1 > END_3 > END_2$. From 2010 to 2015, the influence of exogenous driving factors was $EXD_2 > EXD_4 > EXD_3 > EXD_1$, and the influence of endogenous driving factors was $END_4 > END_2 > END_1 > END_3$. From 2015 to 2018, the influence of exogenous driving factors was $EXD_2 > EXD_4 > EXD_3 > EXD_1$, and the influence of endogenous driving factors was $END_4 > END_2 > END_3 > END_1$ (Figure 4).

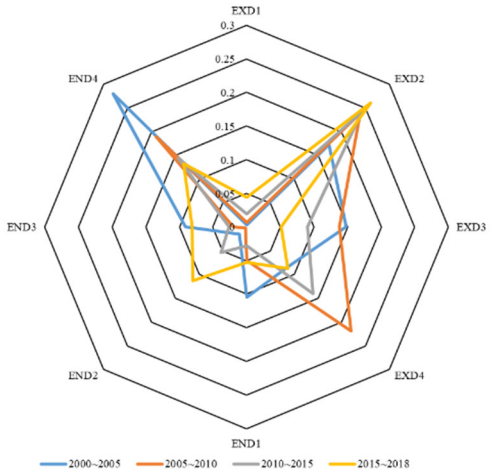

Figure 4. The mean annual variation in the driving forces influencing intensity.

The reason for the evolution of exogenous driving is the rapid rise of inland open highlands in Chongqing since the 'Eleventh Five-Year', and the opening of the Chongqing-Sinkiang-Europe International Railway and the Chongqing-Shenzhen Railway-Sea Intermodal Transport. With total imports and exports of $12.4 billion, 'Going Out' has made breakthrough progress, further increasing the impact on rural areas. Rural employment channels continue to expand, and farmers' income continues to improve, which enhances the attraction of rural areas, and the influence of rural restructuring is increasing.

3.4.2. Spatial Evolution of the Driving Force Influence

The influence of endogenous and exogenous driving factors on rural comprehensive restructuring has temporal and spatial heterogeneity. The influence of driving factors has time and space nonequilibrium, and the polarization phenomenon is prominent, showing a strong group effect. There is a radiation diffusion effect in regions with a strong force, and regional differences are further increased due to the driven echo effect. The high impact intensity of exogenous driving factors is mainly concentrated in the main urban areas, and has the trend of transferring to the north of the Yangtze River. The high-impact intensity of endogenous driving factors is mainly concentrated in the urban groups of the Three Gorges

Reservoir area in Northeast Chongqing and in some districts and counties in the main urban metropolitan area, and has a spatial pattern of transformation in the urban groups of the Three Gorges Reservoir area in northeast Chongqing and the Wuling Mountain area in southeast Chongqing. The influence intensity of exogenous driving on rural comprehensive restructuring decreased after rising over time, and the influence intensity of endogenous driving showed an evolution pattern of obvious improvement after falling (Figure 5).

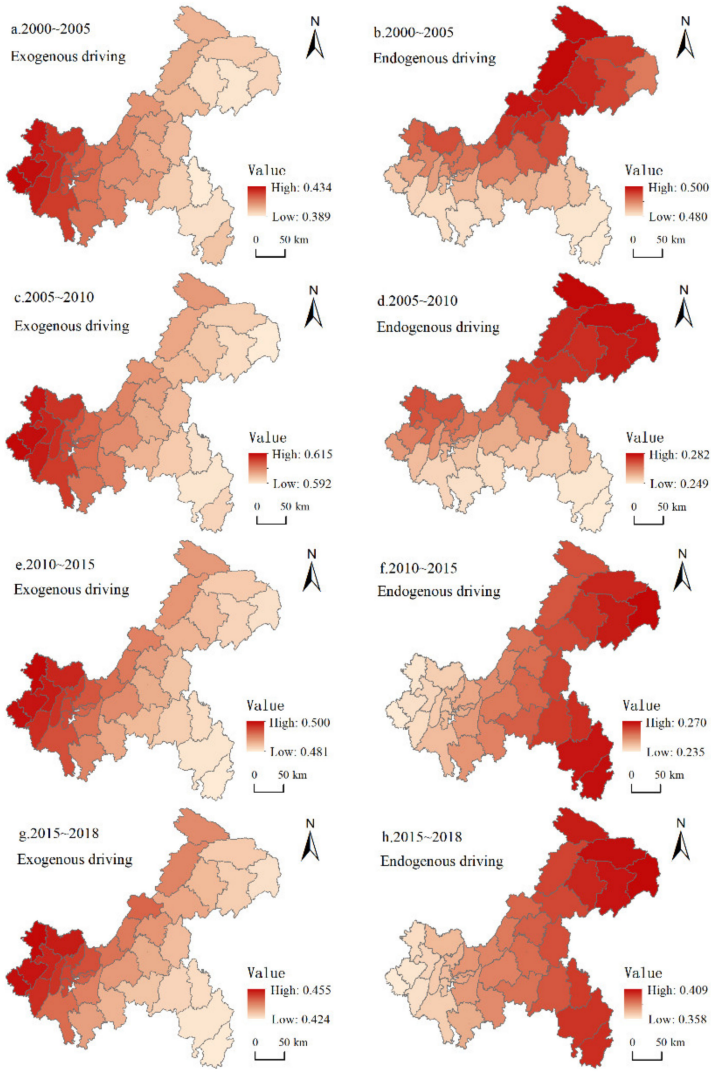

Figure 5. The spatiotemporal differentiation of the influence intensity of endogenous and exogenous driving on rural comprehensive restructuring.

From 2000 to 2010, the spatial distribution pattern of the influence intensity of exogenous driving on rural comprehensive restructuring was stable, and the influence intensity was significantly enhanced. The high-intensity spatial distribution area driven by endogenous areas is the urban group of the Three Gorges Reservoir area in northeast Chongqing and most districts and counties in the main urban area. However, the average effect intensity decreased from 0.491 in the period 2000 and 2005 to 0.264 in the period 2005 and 2015. From 2010 to 2015, the high-value area of exogenous driving influence intensity gradually began to shift to the boundary between Sichuan and Chongqing. The maximum value of influence intensity decreased from 0.615 to 0.5, and the minimum value decreased from 0.592 to 0.481. The spatial distribution pattern of endogenously driven high intensity gradually shifted to the urban groups of the Three Gorges Reservoir area in northeast Chongqing and the Wuling Mountain area in southeast Chongqing, and the average im-

pact intensity was as low as 0.252. The spatial distribution pattern of exogenous driving influence intensity during 2015–2018 still has a trend of slowly moving to the Sichuan–Chongqing border compared to the period 2010–2015. The spatial impact pattern driven by endogenous factors was consistent from 2010 to 2018. With the further progress on poverty alleviation, the average impact intensity of rural comprehensive restructuring in the study area increased to 0.380 (Figure 5).

From 2000 to 2005, in the process of rapid industrialization in the study area, industrial development played a strong role in the exogenous driving forces of rural restructuring. The endogenous driving forces of agriculture, forestry, animal husbandry, and fishery services effectively promoted the restructuring. The influence of endogenous and exogenous driving forces on rural comprehensive restructuring was relatively balanced resulting in a relatively balanced period for the endogenous and exogenous factors to drive rural comprehensive restructuring. From 2005 to 2010, the study area implemented the strategy of big reform, big opening up, and big development to build an inland open highland, and the driving effect of imports and exports on rural restructuring was obvious. With the implementation of 'agriculture, rural areas and farmers' work and regional coordination work, 'Farmhouse Fun' and 'Family Hotel' widely developed in the study area, and the development of homestays entered the initial stage. In addition, the agriculture, forestry, animal husbandry, and fishery service industries still actively responded to rural restructuring. The spatial pattern of the impact of endogenous and exogenous driving forces on rural comprehensive restructuring is consistent with that from 2000 to 2005, but the impact intensity of endogenous and exogenous driving factors shows significant differences. The influence of exogenous driving is more than 50%, which is the stage of exogenous driving leading to rural comprehensive restructuring. From 2010 to 2015, the social and economic development model of the study area changed, and the concepts of high quality, high efficiency, and green environmental protection were considered. The development of some polluting industries is limited by macro policies, and the driving force of industrial development on rural restructuring has weakened. However, the overall situation of economic development, especially the import and export industries, still maintains a strong driving force. The appearance of districts, counties, and small towns has changed significantly. The urbanization rate of the permanent population has reached 60.9%, and the response of the non-agriculturalization rate of rural employment has gradually emerged. Although the influence pattern of endogenous and exogenous driving forces on rural comprehensive restructuring shows almost the opposite distribution, the influence intensity of exogenous driving is much higher than that of endogenous driving, and it is still the stage of rural comprehensive restructuring dominated by exogenous driving. From 2015 to 2018, with the full implementation of the fight against poverty, rural restructuring in the study area ushered in a new round of changes in the context of increasing policy support and endogenous motivation. The impact intensity of import and export industries is not conspicuous in the short term, but it still has a strong positive effect on rural restructuring. The phenomenon of non-agricultural employment in rural areas has become more prominent, and the differences between districts and counties are manifested. The influence pattern of endogenous and exogenous driving forces on rural comprehensive restructuring still has a relatively distributed pattern, but the intensity of endogenous and exogenous driving forces is relatively balanced, which is the stage of rural comprehensive restructuring dominated by endogenous and exogenous driving.

4. Discussion

4.1. Study on Rural Restructuring over Long Time Period in Mountainous and Hilly Areas Reveals Regional Differences and Time Period Evolution

In this paper, the entropy method, spatial econometric model, and GTWR model are used to enrich rural research methods and further strengthen the systematicity of rural reconstruction research based on the introduction of the existing gravity model [63], network analysis [64], system dynamics model [65], and mixed particle swarm optimization [66]. From the perspective of exogenous and endogenous driving, this paper discusses the

spatial and temporal evolution pattern of the influencing factors on rural restructuring in Chongqing from 2000 to 2018. It breaks through the existing quantitative measurement of long-term rural restructuring and mainly conducts a qualitative evaluation of the influencing factors on long-term rural restructuring. The quantitative evaluation mainly focuses on rural restructuring at the village scale [67–69]. For example, guided by the theories of niche [70], living situation [71], quality of life [72], and symbiosis [73], the conflicts between the current rural settlement space and other spaces are identified through suitability evaluation, and then the spatial position and scale of the rural settlement are adjusted through relocation, renovation, and transformation, to promote the improvement of the intensive utilization level of rural settlement space and the coordination of production, life, and ecology [74]. Through research, the overall speed of economic restructuring in the study area is gradually accelerated, and the change in spatial restructuring is obvious but still lagging. The exogenous driving hurts the change in rural restructuring in the study area, while endogenous driving has a positive impact. The change in endogenous driving factors is more obvious than that in exogenous driving factors. Rural restructuring in rural areas of central China begins with social restructuring caused by the extraterritorial migration of population and employment. Economic-social restructuring is the mainstream mode of rural restructuring at this stage [35]. The rural restructuring in the developed agricultural areas in eastern China starts from the rural economic restructuring caused by the transformation of industry and employment, and the equilibrium of economic-social-spatial restructuring is the mainstream model of rural restructuring at the present stage [75]. Considering the differences in regional development conditions and processes, research on rural restructuring can enrich the spatiotemporal maps of rural restructuring evolution and its driving forces in different regional types.

Exploring the spatial distribution and temporal evolution of rural restructuring in Chongqing and its relationship with driving factors can enrich and improve the mechanism of rural restructuring in mountainous and hilly areas. To further improve the level and ability of policy consultation of rural restructuring research on optimizing and restructuring rural settlements in mountainous and hilly areas, this paper provides a scientific basis for rural restructuring in mountainous and hilly areas in order to take appropriate human intervention so that it develops along the preset path and promotes the comprehensive revitalization of rural areas in mountainous and hilly areas.

4.2. Promoting Rural Revitalization by Stimulating Internal Motivation

For a long time, the exogenous driving effect of rural restructuring in the study area was obvious, and the exogenous driving mainly hurts rural restructuring, while endogenous driving had a positive impact on rural restructuring. At present, rural restructuring in the study area is driven by exogenous–endogenous equilibrium, which is in the strengthening period of endogenous-driven rural restructuring. It is necessary to pay attention to the endogenous development of the study area. Unlike the exogenous development realized by government planning and introducing foreign capital, endogenous development attaches great importance to the value of the region itself, which is a regional development model from inside to outside and from bottom to top [76]. Most sociological studies believe that endogenous development should be achieved through various forms of social mobilization. For example, through the initiative and implementation of construction projects initiated by residents in the region, or with the assistance of external public welfare organizations, community-based development intervention should be carried out until the endogenous development ability of the locale itself is cultivated [77]. Studies in the field of economics also recognize the role of social mobilization in endogenous development practice [78]. However, more economic studies tend to achieve regional endogenous development through various forms of local industrial integration, urban–rural exchanges, and government policy guidance. For example, Japan's industrial integration with highway stations as the carrier, the urban–rural communication industry developed by Miyama Town in Kyoto Prefecture, and the direct subsidy policy for areas with unfavorable condi-

tions, such as rural areas, have played a role in promoting rural endogenous development to varying degrees [79]. Although the practice is different, it also reflects some common characteristics of endogenous development practice, including a high degree of completion of development planning, residents' understanding and recognition, leaders with professional knowledge, and adequate financial support [80]. These specific characteristics make endogenous development more operable and improve the possibility of its promotion and application.

Combined with the current situation of Chongqing, the study area should fully consider the regional relevance and differences in rural restructuring under various driving forces, form a positive interaction between the internal subsystem of rural areas and the external development process [81], and formulate policies and strategies to improve the endogenous driving restructuring as a whole to promote rural revitalization. Based on this, this paper puts forward the following suggestions to improve the driving force of rural internal development: on the restructuring path, by mobilizing the enthusiasm of stakeholders in rural areas, the adaptive governance system of stakeholder integration in the rural regional system is constructed, strengthening multiple interactions and collaborative governance of stakeholders, and enhancing the adaptability of the system; encouraging residents, enterprises, and local governments in the region to become the leaders of regional development, based on the differences between urban and rural regional systems and the multifunctional value of rural areas, relying on the prosperity of the internet economy, the experience economy, and the creative cultural industry, taking land transfer, national land space renovation, and land space planning as an opportunity to actively promote the organic integration of space restructuring and organic agriculture, ecological tourism, education and culture, health and health preservation [82], and realize the independent and sustainable development of economy, society, and culture in the region by expanding local industries and extending industrial chains [83]. In terms of restructuring guarantees, relevant systems and policies affect the practice of rural restructuring by influencing the efficiency of population, land, capital, and other production factors. The solution to related problems, such as the cutinization of the agricultural transfer population, the revitalization and utilization of homesteads, the moderate-scale management of cultivated land, and the construction of a modern agricultural production system, depends on the overall coordination of land, finance, household registration, social security, and other departments, jointly promoting the reform of relevant macroeconomic policies [84]. Especially with the advancement of urbanization and the diversification of farmers' livelihoods in suburban areas of large cities, the rural resident population has decreased sharply, and the inefficient use of homestead land and the abandonment of cultivated land have become increasingly prominent [85]. It is necessary to speed up the design of the rural land system reform framework. First of all, with the support of the 'separation of three rights' policy of rural homestead and the 'separation of three rights' policy of contracted land, the land value (including production value, ecological value, and cultural value) and the income evaluation mechanism is established to provide transparent and fair information guarantee for land transactions and circulation. Secondly, given the close relationship between the contracted land and the homestead as an important means of production and living for farmers, to effectively solve the land problem, we can further explore the possibility of collaborative promotion of the two types of 'three rights separation' reform, and realize specific collaborative practices in land supply, spatial layout, and reform supervision. Finally, idle revitalization is to make better use of resources, develop the countryside, and enhance the endogenous development momentum of the countryside. Therefore, in the process of reform, it is not only necessary to prevent the weakening or loss of farmers' dominant position, but also to prevent the risk of farmers' unemployment. Strengthening the ability of a rural regional system to cope with external pressures and challenges by upgrading the integration of factors, motivating power, planning guidance, capacity cultivation, and institutional guarantees, and focusing on the coordination and integration of internal and external sources of rural restructuring and development [86]. By making good use of the

resultant force and tension of internal and external driving forces, the sharing degree of rural restructuring integration gains will be continuously improved, and the equilibrium mechanism of the regional system will be transformed into the practical effectiveness of rural revitalization. The comprehensive improvement of industrial revitalization, physical space integration, and rural spiritual core, will be realized and the endogenous driving force of rural development will be enhanced [87]. The comprehensive promotion of industrial revitalization, material space integration, and rural spiritual core will be realized, and the endogenous power of rural development will be enhanced.

4.3. Research Prospects

Given that rural space is an important part of regional space, the research results can be used as an important reference for determining the future function orientation and development orientation of each district and county. However, the study takes districts and counties as spatial units. In the future, it can further reflect the real situation of rural space at the level of town and village, dynamically measure the temporal and spatial evolution characteristics of rural reconstruction in the evolution of different years at multiple scales, and further clarify the regularity, difference, particularity, and contingency of rural development in different scales and different types of regions. For the research on rural restructuring at the village level, we can analyze the differentiated direction and ability of heterogeneous groups with spatial attributes to influence regional rural restructuring through more objective interview research and village geography information, on the basis of a questionnaire and data acquisition, combined with big data and artificial intelligence technology, obtain extensive and abundant long-term survey data, and conduct quantitative measurement, and further explore the participation mode or mechanism of different factors in the process of rural restructuring.

5. Conclusions

(1) During the study period, the average values of the rural economic restructuring intensity index, social restructuring intensity index, spatial restructuring intensity index, and comprehensive restructuring intensity index are 0.138, 0.118, 0.123, and 0.379, respectively. The mean values of the economic restructuring intensity indices in the four research periods are 0.15, 0.17, 0.16, and 0.07, respectively; the mean values of the social restructuring intensity indices are 0.09, 0.13, 0.08, and 0.18, respectively; the mean values of the spatial restructuring intensity are 0.23, 0.09, 0.06, and 0.12, showing nonlinear growth. Overall, the speed of economic restructuring has gradually accelerated, the spatial restructuring has changed significantly but still lags, and the social restructuring and spatial restructuring are more obvious from 2015 to 2018. During the study period, rural restructuring in Chongqing has gone through four stages: spatial-economic restructuring, economic-social restructuring, economic restructuring, and social-spatial restructuring. Various types of rural restructuring are characterized by regional differentiation and spatial agglomeration. Among them, the high-value areas of the economic restructuring intensity index are mainly concentrated in the boundary between Sichuan and Chongqing, and Guizhou and Chongqing. The high-value areas of the social restructuring intensity index change from a relatively concentrated distribution in some districts and counties to a relatively balanced distribution in the whole region. The high-value areas of the spatial restructuring intensity index show the spatial characteristics of small-scale aggregation distribution and large-scale scattered distribution from relatively concentrated distribution.

(2) Different types of rural restructuring are affected by exogenous–endogenous factors. Exogenous driving hurts the change in rural restructuring in the study area, while endogenous driving has a positive impact. Specifically, the influence degree of exogenous and endogenous driving is rural space restructuring > rural comprehensive restructuring > rural economic restructuring > rural social restructuring. Spatial restructuring is most affected by exogenous and endogenous driving, showing a

significant positive impact. For each 1% increase in EXD_4, the county rural spatial restructuring receives a feedback increase of 0.334%. For each 1% increase in END_4, the county rural spatial restructuring receives a feedback increase of 0.297. Exogenous driving has a significant negative impact on rural comprehensive restructuring, and endogenous driving has a significant positive effect. Economic restructuring and social restructuring are less affected by exogenous and endogenous driving. In addition, rural comprehensive restructuring, economic restructuring, and social restructuring all have negative spatial spillover effects, while spatial restructuring shows positive spatial spillover effects.

(3) The driving system composed of exogenous driving and endogenous driving shows obvious temporality and dynamic volatility, and the force intensity of various factors in different stages of development and the comprehensive restructuring of rural areas obviously show different characteristics. The exogenous driving factor of rural restructuring in each research period is EXD_2, and the contributions are 42.23%, 39.66%, 49.32%, and 58.87%, respectively. The endogenous driving factor is END_4, and the contributions are 57.08%, 62.71%, 57.38%, and 34.98%, respectively. The change in endogenous driving factors is more obvious than that in exogenous driving factors. From 2000 to 2005, rural restructuring in the study area was driven by endogenous and exogenous factors. From 2005 to 2010, the influence of exogenous driving reached more than 50%. From 2010 to 2015, the influence intensity of exogenous driving was much higher than that of endogenous driving, and 2005–2015 was the dominant stage of exogenous driving. 2015–2018 is the equilibrium driving stage of endogenous and exogenous factors.

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