Evaluating the Corresponding Relationship Between the Characteristics of Resource Utilization and the Level of Urbanization—A Case Study in Chengdu-Chongqing Economic Circle, China.

Ying Zhou

Sichuan Agricultural University

Zhuolu Li

Sichuan Agricultural University

Yuan Chen

Sichuan Agricultural University

Wei Wei (✉ jpwfz@sicau.edu.cn)

Sichuan Agricultural University <https://orcid.org/0000-0003-4984-6464>

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Evaluating the corresponding relationship between the characteristics of resource utilization and the level of urbanization: a case study in Chengdu-Chongqing Economic Circle, China.

Ying Zhou¹, Zhuolu Li¹, Yuan Chen¹, Wei Wei^{1*}

¹ School of Architecture and Urban Planning, Sichuan Agricultural University, Sichuan 611830, China; E-Mails: zhouying3333@163.com (Y.Z.); nyanya000@163.com(L.Z.L.); cyuanyuaner@163.com (Y.C.); jpwflz@sicau.edu.cn (W.W.).

* Address of Corresponding Author: School of Architecture and Urban Planning, Sichuan Agricultural University, Sichuan 611830, China; E-Mail: jpwflz@sicau.edu.cn; Tel.: +8615982343612.

Declarations

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Abstract

The Chengdu-Chongqing Economic Circle is an important center for promoting economic growth in the western region. Clarifying the driving force and restrictive factors of the urbanization development in Chengdu-Chongqing area is conducive to the further development of the region. First, this study uses piecewise linear regression to determine the characteristics of resource consumption. Then use Moran index to test the spatial agglomeration relationship. Finally, combining the characteristics of resource utilization and spatial agglomeration effects in Chengdu-Chongqing area, 143 cities are classified. The results show that: (1) The Chengdu-Chongqing economic circle as a whole presents the characteristics of high resource utilization pressure and abundant resource content. (2) In areas with obvious agglomeration effects, most cities have less pressure on natural resources, lower resource levels, less investment in environmental protection, and higher levels of urbanization. (3) The pressure on the use of natural resources and the expropriation of environmental protection measures are matched with each other in areas with significant concentration. (4) With the development of cities, the characteristics of resource utilization in various regions will tend to be unified. Researching and exploring the characteristics of resource utilization in the Chengdu-Chongqing Economic Circle will help the government to formulate relevant policies to ensure the coordinated development of regional ecology and the city.

Keywords: Urbanization. Natural resources. PSR. Piecewise regression analysis. Moran Index. Chengdu-Chongqing Economic Circle

Introduction

Rapid urbanization is an important trend of current world development. The main features are economic development, population migration, urban spatial expansion, etc. (C. Li, Li, & Wu, 2013) At present, the more developed areas such as North America and Europe have a relatively high degree of urbanization, and the underdeveloped regions will become the main driving force for the growth of world cities (Madlener & Sunak, 2011). Today, more than 50% of the world's population lives in urban areas. According to United Nations projections, by 2050, the global population will increase to 9.3 billion. Among them, the urban population will increase to 6.25 billion, and 75% of the world's population will live in cities and their surrounding areas. In addition, 83% of the world's urban population will live in

58 underdeveloped areas(UN, 2012).

59 The rapid development of urbanization also consumes a lot of natural resources. There is constant
60 interaction between people and the land, and the land changes from a natural state to a state used by
61 humans (Yansui Liu, 2018). At the same time, the concentrated use of water resources has also led to
62 an increase in water pressure. This promotes climate and environmental changes(R. I. McDonald et al.,
63 2011; Robert I. McDonald et al., 2014). Cities occupy only 2% of the world's area, but consume 75% of
64 the world's resources and are accompanied by a large amount of emissions. The International Energy
65 Agency predicts that by 2030, the proportion of urban energy demand will increase to 73% and carbon
66 dioxide emissions will increase to 76%(IEA, 2008). Moreover, comparing large cities in developed and
67 developing countries, excluding traditional energy consumption, it can be found that the per capita energy
68 consumption in developing countries is lower than that in developed countries.(Madlener & Sunak, 2011)
69 Therefore, analyzing the consumption of urban natural resources can also judge the urbanization process.

70 Natural resources and urban development influence each other. The ecological environment is the
71 external condition of urban development and the foundation of sustainable urban development.(T. Peng
72 & Deng, 2021). Natural resources such as water resources, forests, land, and minerals are all necessary
73 conditions for development(Nathaniel, Nwulu, & Bekun, 2021). But the rapid urbanization process will
74 also cause problems such as resource degradation and environmental pollution.

75 According to the "China Statistical Yearbook", from 2000 to 2018, China's urbanization level rose
76 from 36.22% to 59.58%, which shows the rapid development of Chinese cities. As the fourth largest
77 urban agglomeration in China, the Chengdu-Chongqing urban agglomeration has experienced rapid
78 urbanization in the past few decades. From 2001 to 2015, the urbanization level of Sichuan Province rose
79 from 26.70% to 52.3%, and the urbanization level of Chongqing City rose from 35.6% to 65.6%. In
80 recent years, the rapid development of Chengdu-Chongqing area has attracted a large amount of
81 resources inflow. The GDP of Sichuan Province and Chongqing City increased from 617.153 billion
82 yuan to 457.037 billion yuan, and the built-up area increased from 1421.67 square kilometers to 3611.1
83 square kilometers. As shown in Figure 1, the overall economy of Chengdu-Chongqing area has doubled,
84 and the city has expanded significantly. The other three urban agglomerations that were identified earlier
85 and developed rapidly are the Yangtze River Delta, the Greater Bay Area, and the Beijing-Tianjin Wing.
86 In 2020, the Chengdu-Chongqing urban agglomeration determined by the "Outline of the Construction
87 Planning for the Chengdu-Chongqing Twin City Economic Circle" is located inland and has important
88 research value..

Fig.1 Changes in GDP and built-up area of Sichuan Province and Chongqing City from 2001 to 2015

There have been studies that have proved that there is a non-linear relationship between natural resource development and urbanization development (Yaobin Liu, 2014; J. Peng et al., 2017). However, due to the acceleration of industrialization and rapid economic development, environmental pollution and ecological destruction are inevitable problems in the development process. At this time, the degree of urbanization and the amount of resource possession will affect the way of resource development. For example, areas with low levels of urbanization are mostly areas with low resource development efficiency, which will cause more environmental problems. The development of resource-rich areas is too dependent on the environment, which can easily lead to industrial imbalances and affect energy conservation, emission reduction and environmental protection. (Ahmed, Asghar, Malik, & Nawaz, 2020; He et al., 2021; K. Wang et al., 2019). There have been many studies using piecewise linear regression to identify the threshold of ecosystem changes, such as testing the threshold of habitat changes (Francesco Ficetola & Deno, 2009; Garabedian, Moorman, Nils Peterson, & Kilgo, 2017), the threshold of socio-economic impact on urban landscape (W. Liu, Holst, & Yu, 2014), the ecosystem response to urbanization Threshold (Haase, Frantzeskaki, & Elmqvist, 2014).

In addition, the relationship between environmental change and urbanization also has different temporal and spatial characteristics. Most of these studies pay more attention to the changes in urban temporal and spatial patterns. By exploring the characteristics of urbanization development (Yaobin Liu, 2014) studying changes in natural resources over the past few decades (Topcu, Altinoz, & Aslan, 2020), distinguish urban ecological landscapes (C. Li et al., 2013; Jian Peng, Shen, Wu, Liu, & Wang, 2015), changes in natural resources (J. Li, Li, Zhu, Song, & Wu, 2013; Shahbaz, Loganathan, Muzaffar, Ahmed, & Ali Jabran, 2016) (Y. Li, Cao, Long, Liu, & Li, 2017) or predict future development (Fang et al., 2019). In terms of space, it mainly includes the spatial dynamic response of natural resource production to the

urbanization process(R. I. McDonald et al., 2011) , urbanization and environmental resource utilization(Ding & Peng, 2018)、 the evaluation of the spatial relationship of environmental carrying capacity(K. Li, Jin, Ma, & Jiang, 2019), urban sprawl methods, and the visualization research of urban agglomeration effects(Ramachandra, Bharath, & Sowmyashree, 2015), etc.

As far as research purposes are concerned, most of the current research is to assess the current changes in the natural environment, or the impact of changes in the natural environment on urbanization. There are few studies on the relationship between the process of urbanization and the change of resources and environment, which is of great significance to the study of the development of the Chengdu-Chongqing economic circle. Therefore, the main purpose of this research lies in three points: (1) Determine the response relationship between comprehensive utilization of resources and urban development; (2) Determine the spatial agglomeration effect of the Chengdu-Chongqing area; (3) Exploring the balance between resource utilization and urbanization level in Chengdu-Chongqing region will help each region integrate its own characteristics to improve development strategies. The second part of this article introduces basic data, data processing methods and models. The third part is the analysis result of the model. The fourth part discusses and analyzes the results. The fifth part is a summary. References and appendices at the end of the article.

Methods

Study area and data sources

According to the "Urban Group Development Plan" issued by the National Development and Reform Commission, the subjects of this survey have been determined. It has jurisdiction over 142 districts, including 113 cities in Sichuan Province and 29 cities in Chongqing. The Chengdu-Chongqing urban agglomeration has a vast area, with a total area of 185,000 square kilometers. Its geographic location is between 101°55'-109°14'51" east longitude and 27°39'-32°19'18" north latitude. It is located in the Sichuan Basin east of the Yangtze River in China. There are many mountains and rivers in Chengdu-Chongqing area, the terrain is undulating, and the water resources and forest resources are abundant. The Chengdu-Chongqing area has a subtropical humid monsoon climate, with annual precipitation of 1107.8 mm and 1406.4 mm respectively. The annual average temperature is 16.4 and 19.2 degrees Celsius respectively. It has a long history and rich natural and cultural landscape.

The data used in this article includes statistical data and spatial data. Statistical data mainly come

from "Sichuan Statistical Yearbook 2016", "Chongqing Statistical Yearbook 2016", "Water Resources Bulletin", "Sichuan Environmental Resources Bulletin", "Chongqing Environmental Resources Bulletin", yearbooks and environmental bulletins corresponding to cities in the Chengdu-Chongqing Economic Circle. The missing data is supplemented by data from adjacent years, interpolation method, or distribution according to the total amount. Geospatial data comes from China Environmental Resources Science and Data Center (<https://www.resdc.cn/Default.aspx>).

Fig.2 Geographical location of study area

Index system

The rapid development of Chengdu-Chongqing area has brought increasing pressure on the ecological environment. Economic growth is accompanied by a large amount of resource consumption and pollutant discharge. With the rapid development of urbanization, the urban ecological environment is gradually deteriorating. In order to measure the interaction between the level of urbanization and natural resources in Chengdu-Chongqing area, this study constructed a PSRU model. The PSR model is widely used in resources(H. Liu & Men, 2018; Q. Wang et al., 2013), ecological carrying capacity(Wei, Guo, Wu, & Ye, 2014), and ecological safety assessment (Fan & Fang, 2020; Sun, Li, Gao, & Xia, 2018) and so on. The model is constructed from three directions: human consumption patterns, institutional conditions, and strategies to promote sustainable development, making the model systematic and causal. Then establish an index system to evaluate the degree of urbanization, and record it as the U subsystem. The research on urbanization mostly starts from economy, population, society, ecological environment and public services, while the selection of ecological environment indicators mostly starts from natural conditions and environmental governance. Therefore, the PSRU model can simultaneously reflect the

comprehensive utilization of natural resources and the level of urbanization in the Chengdu-Chongqing Economic Circle.(Cui, Fang, Liu, & Liu, 2019; Fang et al., 2019; Verma & Raghubanshi, 2018). The specific model is shown in Fig.3. The P subsystem reflects the burden of urban development on environmental resources. The S subsystem reflects the total amount of urban ecological resources. The R subsystem reflects the measures taken by various regions in response to ecological deterioration. The U subsystem is composed of population, economy, environment and space. Due to the large differences in urban development in Chengdu-Chongqing area, the P subsystem adopts an index that can reflect the density to eliminate the influence of area on the index. The S subsystem and R subsystem reflect the overall level of the area, so use indicators that reflect the total amount. The selection of U subsystem indicators considers these two types. See Table 1 for specific indicators.

Fig.3 The relationship between the PSRU system

Table 1 PSRU system index system

Target layer	Criteria layer	Indicator layer	Units	Index type
PSRU	Pressure	Unit agricultural output value (P ₁)	Ten thousand yuan of per sq. km	+
		Unit forestry output value (P ₂)	Ten thousand yuan of per sq. km	+
		Per capita of water consumption (P ₃)	m ³	+
		Energy consumption of per ten thousand industrial GDP (P ₄)	1t	+
	State	Sown area of crops (S ₁)	Hectares	+
		Total water resources (S ₂)	10 ⁸ m ³	+
		Forest area (S ₃)	sq. km	+
		Comprehensive Air Quality Index (S ₄)		-
	Response	Sewage treatment rate (R ₁)	%	+
		Energy saving and environmental protection expenditure (R ₂)	Ten thousand yuan	+
		Pollution prevention expenditure (R ₃)	Ten thousand yuan	+

	Decrease rate of fertilizer use (R ₄)	%	+
Urbanization	GDP density (U ₁)	Ten thousand yuan of per sq. km	+
	The population density (U ₂)	Person of per sq. km	+
	Green coverage rate of built-up area (U ₃)	%	+
	Per capita public green area (U ₄)	per capita of sq. m	+

180

181 Quantify urban resource consumption and comprehensive development level

182 (1) Standardization

183 The Chengdu-Chongqing Economic Circle includes 142 districts, and there are big differences in
 184 the level of urban development and the level of natural resource utilization. In order to compare regions
 185 with a large gap in development level, it is necessary to standardize the data first, and then quantify the
 186 consumption of ecological resources and the level of urban development. The standardized formula is as
 187 follows:

$$188 \quad \text{Positive index: } X'_{ij} = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)}$$

$$190 \quad \text{Reverse index: } X'_{ij} = \frac{\max(X_j) - X_{ij}}{\max(X_j) - \min(X_j)} \quad (1)$$

191 Where X'_{ij} is the standard value, X_{ij} is the original value, $\max(X_j)$ is the maximum value of the j -th
 192 index of all samples, and $\min(X_j)$ is the minimum value of the j -th index of all samples.

193 (2) Entropy method

194 Entropy method is often used in the study of ecological and environmental problems (Fu, Zhuo,
 195 Song, Wang, & Ren, 2020; He et al., 2021). Due to the characteristics of the entropy method, the weight
 196 of the subsystem can be determined by the degree of deviation of each index, which can better retain the
 197 characteristics of the data and reduce the loss of information. Therefore, this study chooses to use the
 198 entropy method to process the data in the PSRU system. Import the standardized data into the entropy
 199 formula, the calculation formula is as follows:

$$200 \quad P_{ij} = \frac{X'_{ij}}{\sum_{i=1}^n X'_{ij}} \quad (2)$$

$$201 \quad e_i = -\frac{1}{\ln(n)} \sum_{j=1}^m P_{ij} \ln P_{ij} \quad (3)$$

$$202 \quad W_i = \frac{1 - e_i}{\sum_{i=1}^n (1 - e_i)} \quad (4)$$

$$U_j = \sum_{j=1}^m X'_{ij} W_j \quad (5)$$

X'_{ij} represents the standardized value of the i -th index and the j -th area. e_i and W_i are the entropy and comprehensive weight corresponding to the index. U_j represents the comprehensive development index of the area.

207 Piecewise linear regression

In order to show the relationship between the utilization of ecological resources and the development of urbanization, the PSR subsystem is the independent variable, and the U subsystem is the dependent variable. Use Matlab to fit the scatter plot. The fitting method is to determine the straight line formed by the predicted value. At this time, there is the smallest absolute residual between the predicted value and the actual value. After testing, there is an obvious steering relationship between the PSR subsystem and the U subsystem, so piecewise linear regression is used for fitting (Toms & Lesperance, 2003), and the fitting formula is summarized as follows:

$$Y = \begin{cases} \beta_0 + \beta_1 X_i & \text{for } X_i \leq \alpha \\ \beta_0 + \beta_1 X_i + \beta_2 (X_i - \alpha) + e_i & \text{for } X_i > \alpha \end{cases} \quad (6)$$

Y is the value of urbanization development level. X_i respectively refers to the corresponding value of the development level of the PSR subsystem. e_i is the error term, and α is the threshold.

218 Spatial correlation analysis

Spatial autocorrelation emphasizes spatial correlation. Spatial correlation includes positive correlation and negative correlation, both of which indicate significant correlation. The difference is that positive spatial correlation means the aggregation of spatial distribution positions, and negative spatial correlation means that spatial distribution positions are more discrete. Moran index can be used to analyze global correlation. After determining that the global correlation exists, in order to clarify the specific aggregation state, the local Moran index can be used. The global and local correlation Moran index formulas are as follows:

$$I = \frac{n}{S_0} \times \frac{\sum_{i=1}^n \sum_{j=1}^n W_{ij} (Y_i - \bar{Y})(Y_j - \bar{Y})}{\sum_{i=1}^n (Y_i - \bar{Y})^2} \quad (7)$$

$$I_i = \frac{Y_i - \bar{Y}}{S^2} \sum_{i=1, j \neq 1}^n W_{ij} (Y_i - \bar{Y}) \quad (8)$$

$$S_0 = \sum_{i=1}^n \sum_{j=1}^n W_{ij} \quad (9)$$

$$\bar{Y} = \frac{1}{n} \sum_{i=1}^n Y_i \quad (10)$$

I is the global Moran index, I_i is the local Moran index of the i -th area. N is the total number of spatial units. Y_i and Y_j represent the attribute values of unit i and unit j , respectively. W_{ij} is the spatial weight value.

Mapping the spatial image of urbanization and ecological resources

Chengdu-Chongqing regions have different resource conditions and different levels of urbanization. The quantified results of the PSRU system show different levels of comprehensive development in different regions. Therefore, the coefficients of P subsystem, S subsystem, R subsystem and U subsystem are respectively associated with the administrative boundary map of prefecture-level cities in the Chengdu-Chongqing urban agglomeration. Drawing the comprehensive coefficient map of each subsystem can directly reflect the development of the Chengdu-Chongqing economic circle.

Results

Calculation of PSRU

Formula (1) is used to calculate the entropy value of the PSRU system in the Chengdu-Chongqing area. The city abbreviations, raw data and PSRU system weights are shown in Table 2, Table 3 and Table 4, respectively. The comprehensive development level of Chengdu-Chongqing city is shown in Table 5.

Table 4 Index weight of PSRU

Criteria layer	Indicator layer	Weight
Pressure	Unit agricultural output value (P_1)	0.198
	Unit forestry output value (P_2)	0.257
	Per capita of water consumption (P_3)	0.188
	Energy consumption of per ten thousand industrial GDP (P_4)	0.356
State	Sown area of crops (S_1)	0.310
	Total water resources (S_2)	0.285
	Forest area (S_3)	0.269

Response	Comprehensive Air Quality Index (S_4)	0.135
	Sewage treatment rate (R_1)	0.106
	Energy saving and environmental protection expenditure (R_2)	0.250
	Pollution prevention expenditure (R_3)	0.379
Urbanization	Decrease rate of fertilizer use (R_4)	0.265
	GDP density (U_1)	0.298
	The population density (U_2)	0.288
	Green coverage rate of built-up area (U_3)	0.111
	Per capita public green area (U_4)	0.304

Fig. 4 Comprehensive development level of PSRU subsystem

The spatial distribution of the development status of the PSRU system is shown in Fig.4. There are obvious spatial differences between the subsystems. The comprehensive development level of the P subsystem is between 0.031 and 0.610, and the overall resource consumption pressure of Chongqing is significantly lower than that of Sichuan. The lowest city is YZ, and the highest is RS. It can be seen from Table 4 that Chongqing's demand for land, forest, water and energy is mostly lower than that of Sichuan. This may be because the level of urbanization in Chongqing is higher than that in Sichuan. This may lead to a relatively high resource utilization efficiency in Chongqing, or a more environmentally friendly

industrial structure. For example, in YZ, the resource pressure is the lowest and it is not engaged in agriculture and forestry production. In RS, where the pressure is the most, the intensity of agricultural and forestry production activities ranks in the forefront of the Chengdu-Chongqing urban agglomeration. In addition, water and industrial energy consumption in the region is in the middle.

The comprehensive level of the S subsystem is between 0.030 and 0.800. On the whole, the level of natural resources in the southeast of the Chengdu-Chongqing Economic Circle is higher than that in the northwest. XH has the highest resource coefficient and WH has the lowest. The resource level of a city is closely related to the degree of urbanization and the region's own natural conditions. For example, XH, which has the highest urbanization resource coefficient, is the city with the largest forest area in the Chengdu-Chongqing urban agglomeration, and the content of other natural resources also ranks in the forefront. In WH, where the state coefficient is the lowest, the level of urbanization is at the forefront of the Chengdu-Chongqing economic circle, and resources have been developed for a long time. Therefore, the content of various resources is relatively small, especially land resources and forest resources.

The coefficient range of the R subsystem is 0.058-0.666, and the areas that attach importance to environmental protection are concentrated in the central and eastern regions of the Chengyu urban agglomeration. The highest is in SL, and the lowest is TC. The factors that have the greatest impact on investment in environmental governance are development-related policies formulated by local governments. Although most cities with high levels of urbanization pay attention to the implementation of environmental protection measures, some areas with slower development also attach importance to environmental protection. Therefore, there is no direct causal relationship between environmental protection investment and the level of urbanization, but there is an indirect relationship. For example, SL has a high level of urbanization. The city directly allocated a large amount of energy conservation and environmental protection funds and pollution prevention funds. However, in TC, the level of urbanization, environmental maintenance investment and pollution control levels are low.

The U subsystem is between 0.008-0.700. The urbanization level of most cities is medium, and the cities with faster development are mainly concentrated in the center of Chengdu, YZ and the surrounding cities. The fastest growing city is YZ, and the lowest is AJ. Population concentration, preferential policies and good natural conditions can greatly promote the development of urbanization. For example, YZ has the highest GDP density and population density, and urban greening is also better. This is a characteristic of highly developed urbanization, and it also provides a good foundation for the sustainable development of urbanization. However, the development of AJ is slow, and the index coefficients such as population, economy and space are all at the end of Chengdu-Chongqing urban

291 agglomeration.

292 **Responses of PSR subsystems to urbanization**

Fig. 5 The response of PSR system to U system

297

298 The response image of PSR to U is shown in Fig. 5. The linear regression trend of PSRU system is:
299 before reaching the threshold, the relationship between the U subsystem and the PSR subsystem is
300 negatively correlated (abbreviated as N). After the threshold, there is a Low-level negative correlation
301 (abbreviated as L) between P and U, while the responses of S-U and R-U have become more obvious
302 positive correlations (abbreviated as P).

303 The response thresholds of PSR to U are 0.145, 0.180 and 0.275, respectively. The relationship
304 between the P subsystem and U subsystem changes the fastest, followed by S subsystem and R subsystem.
305 In addition, from the results of the piecewise regression, the slopes of the PSR subsystem before the
306 threshold are -2.057, -0.957, and -0.154, respectively. When the threshold is reached, the slopes become
307 -0.048, 0.148, and 0.368, respectively. It can be concluded that before the mutation point, the P subsystem
308 is the most sensitive to urbanization development, followed by the S subsystem, and the R subsystem is
309 the least sensitive. After reaching the threshold, the sensitivity of the PSR system to the U subsystem
310 gradually increases, and the most sensitive becomes the R subsystem.

311 In addition, the PSR system has 38, 34, and 75 cities before the threshold, and 104, 108, and 67
312 cities behind the threshold. Taking into account the meaning of the PSR system and the results of
313 segmented regression, cities in different segments have different characteristics. The response
314 relationship of the P subsystem to the U subsystem changes from N to L. The number of cities before the
315 threshold is 26.76%. The pressure brought by the consumption of natural resources in this area will
316 obviously affect the level of urbanization development. However, after reaching the threshold, the
317 pressure on natural resources has not effectively transformed into a driving force for urbanization. The
318 response relationship of the S subsystem to the U subsystem changes from N to P. This means that before
319 reaching the threshold, 23.94% of the cities have low total natural resources, but the resource content has
320 a significant impact on the development of urbanization. After the threshold, there are more urban
321 resources, which have a positive impact on urbanization, but the impact is relatively weak. On the one
322 hand, it can be said that cities before the threshold can use natural resources more effectively. On the
323 other hand, it also means that cities after the threshold still have great potential in the development of
324 natural resources. The response of the R subsystem to the U subsystem first presents N and then becomes
325 P. This means that the environmental protection measures in 52.82% of the regions are not in line with
326 the level of urbanization before reaching the threshold. Urban environmental protection measures after
327 the threshold are effective and can significantly promote urbanization.

328 The PSR system of natural resources is closely related to the U subsystem. Generally speaking,

most of the cities with greater pressure on resource development are concentrated in areas with lower levels of urbanization. In the development process, ecological resources will inevitably be consumed. Therefore, in relatively underdeveloped areas, consuming resources is the most convenient way of development. The massive consumption of resources will bring more impetus to urban development. However, the regression relationship proves that the efficiency of resource development in these areas is low, and cities cannot develop rationally.

The state of natural resources reflects the amount of existing resources. Due to the slower development of resources in areas with low levels of urbanization, the amount of resource possession is higher than areas with high levels of urbanization. However, it can be seen from the S-U threshold image that the level of urbanization in the most resource-rich areas is moderate. This means that these cities are rich in natural resources and have huge development potential for the sustainable development of urbanization. In addition, natural resources in areas with high levels of urbanization are relatively scarce. The development of such urban resources is close to saturation, and more attention needs to be paid to the ecological environment.

The R coefficient reflects the city's investment in maintaining the ecosystem. Most areas with high levels of urbanization have higher environmental awareness than areas with relatively slow urbanization. At the same time, the cities most lacking in environmental protection measures are also cities with a medium level of urbanization. The reason for this phenomenon may be that cities with a medium urbanization level are more eager to achieve faster and better development, so they may ignore the implementation of environmental protection measures. However, it can be seen from the R-U threshold relationship that as the level of urbanization increases, the investment in environmental governance will eventually increase.

3.3 Spatial correlation analysis

(1) Global autocorrelation

The global Moran index of PSRU is shown in Table 6. Using the kernel function of GeoDa software to construct spatial weights, and 999 random tests are performed., and 999 random tests are performed. Univariate correlation reflects whether the subsystem itself is related, and bivariate correlation tests whether there is a correlation between the PSR subsystem and the U subsystem. The global Moran index test results show that the subsystems of PSRU are all $P < 0.01$ and the Moran index is positive, which means that each subsystem has a significant positive correlation, and the overall space has an

agglomeration effect. The binary correlation test results show that both the P subsystem and the S subsystem have a significant negative correlation with the U subsystem ($P < 0.01$, $I < 0$). The R subsystem and the U subsystem are significantly positively correlated ($P < 0.01$, $I > 0$). After proving the significant existence of the global Moran index, the local Moran index can be used to test the clustering mode of urban agglomerations.

Table 6 Moran Index Results

	Univariate correlation			Bivariate correlation (to U)		
	Moran's I	P	Z	Moran's I	P	Z
Pressure	0.392	0.001	6.916	-0.259	0.001	-6.932
State	0.544	0.001	10.647	-0.180	0.001	-5.565
Response	0.526	0.001	10.159	0.359	0.001	10.407
Urbanization	0.456	0.001	9.5025	/	/	/

(2) Local autocorrelation

Fig. 6 Lisa image of PSRU system

In order to clarify the agglomeration effect in Chengdu-Chongqing area, a local spatial correlation analysis was carried out. The Lisa diagram is shown in Fig.6. The colored cities are all cities with

significant correlation ($P>0.05$). According to the autocorrelation relationship, the Chengdu-Chongqing area can be divided into five categories: HH, LL, HL, LH and insignificant. They represent high-level agglomeration areas, low-level agglomeration areas, high-level cities but low-level areas surrounding them, low-level but high-level surrounding cities, and cities without significant agglomeration relationships.

Regardless of the regions with no significant relationship, the regions with significant correlation in the P subsystem can be divided into three types. HH type (21 cities) are mainly concentrated in Deyang, Leshan and Luzhou; LL type (24 cities) are mainly concentrated in Guangyuan and Yunnan area; LH type (4 cities) are distributed around HH area. It can be seen that cities with low-pressure clusters are in the majority. According to the aggregation effect of the S subsystem, there are four types. HH type (13 cities) are mainly distributed in northern Chongqing and Dazhou. Type LL (35 cities) are mainly distributed in the vicinity of Chengdu, Meishan, Zigong and Yuzhong District. Type LH (1 city) is located in Dazhou. Type LL (4 cities) exists in areas near LH. It can be found that in agglomerated areas, cities with fewer natural resources account for the majority. According to the agglomeration effect of the R subsystem, the regions with significant relationships can be divided into four categories. HH type (28 cities) are mainly distributed in Chengdu, Yuzhong, Yubei; LL type (38 cities) are mainly distributed in Deyang, Mianyang, Guangyuan, Ya'an, Meishan, Leshan, Neijiang, Zigong; LH and HL types are located respectively in Around HH and LL areas, and the two types of cities are less in number. It can be found that in areas where the correlation is significant, most cities lack effective environmental protection measures. According to the level of U subsystem, it can be divided into four categories. The HH type (18 cities) city has two gathering areas, one is located in the middle and lower part of Chongqing, such as YZ, and the other is located in the center of Chengdu. LL type (16 cities) is concentrated in Leshan and Yibin. The number of HL and LH cities is still small. In areas with significant correlations, there are slightly more cities with high levels of urbanization than cities with slow urbanization. In short, the HH and LL cities in each subsystem are the most distributed features. The number of LH and HL is relatively small, and they are mainly distributed near HH and LL cities.

Discussion

Divide cities by threshold stage

Fig. 7 Segment the response of the PSR system to the U system according to the threshold

The response of the PSR system to the U system is segmented according to the threshold, as shown in Fig.7, and it can be found that: (1) The cities in the first segment of the PSR system account for 26.76%, 23.94%, and 52.82% respectively. Judging from the response of the PS subsystem to the U subsystem, most cities are in the second stage. However, in the relationship of the response of the R subsystem to the U subsystem, the number of cities in the two stages is roughly equal. This means that the main characteristics of natural resource utilization in the Chengdu-Chongqing Economic Circle are: The pressure of resource utilization is high, but it has not been effectively transformed into the driving force of urbanization. Rich in resources, but slow development of urbanization. Less than half of the cities have effective environmental maintenance measures, and most areas have less investment in environmental governance or poor results. (2) Analyze the number of cities in the two phases of the response of the U subsystem from the PS subsystem. The result shows that most cities in the Chengdu-Chongqing area have a lot of resources, but they are unable to effectively transform the resources into development motives. However, this also shows that the Chengdu-Chongqing area still has great potential for resource development, and new technologies are needed to improve the efficiency of resource conversion power. The response of the R subsystem to the U subsystem indicates that there are slightly more cities in the first stage than in the second stage, which means that there are slightly more cities with ineffective environmental governance than effective cities. In general, the level of environmental maintenance is significantly higher than the level of natural resource utilization and resource development, which means that the environmental protection level of the Chengdu-Chongqing urban agglomeration is higher than the overall equilibrium state.

Classification of cities according to spatial agglomeration effects

Fig. 8 Number of HH and LL cities in the PSR system

The HH and LL types of cities in the PSR system are shown in Fig. 8. In the PSRU system, the number of LL types in the PSR subsystem is greater than that of the HH type, and the proportions of LL-type cities are 53.33%, 72.92%, and 56.92% respectively; In the U subsystem, the HH type is larger than the LL type, accounting for 52.94%. In addition, the city types of the PU subsystem are relatively balanced, and the most unbalanced is the S subsystem.

It can be inferred that in areas with significant correlation, most cities are located in LL, LL, LL, and HH areas of the PSRU system. The following conclusions can be drawn:(1)Among the cities with greater relevance in the Chengdu-Chongqing region, the most common urban characteristics are less pressure on natural resources, insufficient resource levels, less investment in environmental protection, and higher levels of urbanization. (2)In areas with more prominent resource use characteristics, the most tense relationship is the level of natural resources, and areas lacking resources account for 72.92%. It can be seen that with the development of urbanization, changes in resource content are more dramatic than changes in resource utilization pressure and protection measures.

Combined analysis of segmented regression and aggregation effect

Cities in the Chengdu-Chongqing area are classified according to the threshold: before the threshold is reached, the characteristic of PSR-U is N (the comprehensive development coefficient of the PSR subsystem before the threshold is in the range of 0.031-0.145, 0.030-0.180, and 0.058-0.275). After the

threshold is reached, the characteristic of P-U is L (0.145-0.610), and the characteristic of SR-U is P (0.180-0.800, 0.275-0.666). Matching the PSR system aggregation results with the threshold segment type can define the characteristics of different types of cities. Since the local Moran index classification results show that there are fewer cities in the LH and HL categories, only HH and LL cities are discussed here. See Table 7 for specific classification.

Table 7 Categorize cluster cities according to thresholds

Mean	Pressure		State		Response		Urbanization	
	HH(21)	LL(24)	HH(13)	LL(35)	HH(28)	LL(38)	HH(18)	LL(16)
N-N-N		SQ , GP (8.33%)				SQ , GP (5.26%)		
N-N-P		WH , SPB , JLP , JB , YZ , NA (25%)		JN, QY, CH, JJ, WH, SPB, JB, YZ, NA, JLP (28.57%)	SPB, JB, YZ, NA , JLP, JN , CH , QY , WH , JJ (35.71%)		CH,YZ,JB,SPB,JLP ,NA,JJ,QY,JN,WH (55.56%)	
N-P-N		LZ , XC, YL, PA (16.67%)	LZ (7.69%)			LZ , YT , XC , PA , LS , YB , YL (18.42%)		CP,YB (12.5%)
N-P-P		TL , BS , BB , YB , BN , QJ (25%)	KX , YY , WZ , LP , DJ , ZX , QJ (53.85%)	BB , YB , BS (8.57%)	YY , WZ , QJ , YB , BB , BS , BN , JY (28.57%)	YL (2.63%)	BB,BN,YB,BS,TL (27.78%)	
L-N-N	QBJ, SW, LMT (14.29%)	DDK (4.17%)		QBJ, XJ, PJ, QS , NJSZ , DA, GJ , ZLJ, YT , DDK (28.57%)		FC , DL , PJ , QS , WTQ , NJSZ, DA, GJ , ZLJ , YT (26.32%)	DDK (5.56%)	JKH,SW,WTQ (18.75%)
L-N-P				XD , PD , WJ , SL , LQY (14.29%)	PD , XD , WJ , LQY , SL(17.86%)			
L-P-N	AX , MZ , SF , LJ , CN , GH , ZJ, JY , LSSZ , QW, WY , JY , NX (61.90%)	NB (4.17%)	KJ (7.69%)	GH , CZ, DP, NX (11.43%)		JY , AX , MZ , ZT , YX, LJ , JY , NB , JL , YJ , YC , MS , HY , DP , JJ(3) , LS , LSSZ , ZZ , DX , WY (52.63%)		JY,LSSZ,QW ,MC,PS,NX,TC (43.75%)
L-P-P	ST , RS , EMS , RX , LX (23.81%)	DZ , FL, NC , QJ (16.67%)	XH , DZ (1), DZ(2) , FD (30.77%)	PS , PZ , FS (8.57%)	FL , YC , JJ(2) , ZJ , CS (17.86%)		CS,FL (11.11%)	RX,MBYZ, EMS,EBYZ (25%)

From the perspective of the overall development characteristics of the Chengdu-Chongqing area, the main characteristics of the PSRU system in HH and LL cities are different. The main feature of the HH type area in the P subsystem is L-P-N, which accounts for 61.90% of the total number of HH types. The main feature of the LL type area is N-N-P and N-P-P, both accounting for 25%. The main characteristic of the HH type area of the S subsystem is N-P-P, accounting for 53.85%, and the main characteristic of the LL type area is N-N-P and L-N-N, both accounting for 28.57%. The main characteristics of the HH type region in the R subsystem are N-N-P and N-P-P, accounting for 35.71% and 28.57%, respectively, and the main characteristic of the LL type is L-P-N, accounting for 52.63%. The main feature of the HH type area of the U subsystem is N-N-P, which accounts for 55.56%, and the main feature of the LL type is L-P-N and L-P-P, which account for 43.75% and 25%, respectively. The conclusions that can be drawn are: (1) The PSU subsystem is relatively concentrated in the HH type area, and the R subsystem is more concentrated in the LL type area, and the number of cities of the same type exceeds 50%. (2) Although the main characteristics of the spatial aggregation of the PSRU system are different, it can be found that there is an obvious connection between the P subsystem and the S subsystem: the main relationship between natural resource pressure and environmental maintenance is N-P and L-N. Areas with high utilization efficiency of natural resources often have active and effective environmental protection measures, while areas with low utilization efficiency are more likely to neglect environmental governance and maintenance.

Specifically, in areas with significant concentration of pressure, most of the resource utilization characteristics of HH cities are L-P-N. This shows that in areas where high pressure is concentrated, the utilization efficiency of ecological resources is generally low and resources are relatively abundant, but environmental protection investment is still insufficient. Among the LL cities, most of the urban PSR response characteristics to U are negative correlation, negative correlation, positive correlation or negative correlation, positive correlation, and positive correlation. The number of cities in the two is roughly the same. This shows that in areas where low pressure is concentrated, most cities' consumption of natural resources can effectively promote the development of urbanization, and they attach great importance to the effective implementation of environmental protection measures. The difference between the second category and the former is that the latter has more resources, and the higher the level of resources, the better the development of urbanization in areas.

In areas with high concentration of resources, the overall characteristic of most cities belonging to the HH type is that the PSR system has an N-P-P relationship with the U subsystem, followed by an L-P-P correlation. In other words, in areas rich in natural resources, most cities attach importance to the

protection of the ecological environment, and can effectively promote urbanization by consuming natural resources. In LL-type cities, the relationship between PSR systems and U-subsystems has two main characteristics: N-N-P and L-N-N. The former has low level of natural resources, high efficiency of utilization and environmental protection. The latter has low level of resources, low utilization efficiency, and neglects the implementation of environmental governance measures. In addition, comparing the two types of cities, we can find that the former level of urbanization is significantly higher than the latter.

In areas where the spatial coefficients of the R subsystem are relatively concentrated, the main characteristic of HH-type cities is N-N-P, followed by N-P-P. In the former category of cities, consuming natural resources can effectively promote the development of urbanization. Despite the shortage of resources, effective environmental protection measures have been taken. The latter not only can efficiently use resources and protect the environment, but also has abundant ecological resources. The characteristics of resource use in LL cities are mainly L-P-N, followed by L-N-N. It can be seen that in most areas with insufficient environmental protection, resources cannot be effectively transformed into a driving force for urbanization. In addition, most of the cities where the R subsystem has a significant relationship are rich in resources. From the perspective of urbanization, the main characteristic of H-H type areas is N-N-P, which means that areas with rapid urbanization development and significant concentration have high resource conversion efficiency. Although the resource content is small, environmental protection is emphasized. The characteristics of the LL-type are mainly L-P-N, followed by L-P-P. Both types of cities cannot effectively use natural resources, but generally have abundant natural resources. The difference between the two is that in areas with slow urbanization, most cities do not pay attention to environmental protection.

Based on the above content, in view of the characteristics of the resource usage in the four directions of the PSRU system, the following suggestions can be made:

(1) From the perspective of the relationship between resource development and urbanization, areas with high pressure on natural resource development tend to have lower utilization efficiency. Government departments should learn from the effective policies and measures implemented by low-pressure clusters, and improve the distribution relationship between renewable energy and non-renewable energy development according to their own regional characteristics, so as to achieve sustainable economic, social and environmental development. Pay attention to the development of science and technology, increase investment in new technology research, encourage the use of environmentally friendly energy, promote the popularization of supporting facilities in high-pressure areas, and accelerate industrial transformation. At the same time, it is necessary to increase investment

in environmental protection, improve the efficiency of effective resource management, strengthen supervision of high-polluting industries, and ensure that the development of various resources and the discharge of pollutants meet the standards.

(2) Starting from the impact of resource levels on the development of urbanization, most areas with high coefficients attach great importance to environmental protection, but some cities have poor resource utilization efficiency. Government departments can appropriately encourage resource development in these areas and develop local superior resources. For example, constructing water conservancy and hydropower projects in areas rich in water resources, and strengthening the development of coal, natural gas and other resources in areas rich in mineral resources to promote the further development of urbanization. In areas with low resource levels, government departments must first change the direction of urban development, such as developing tourist cities, attracting tourists with unique cultural traditions and natural landscapes, and promoting the tertiary industry to drive urban development. Increase investment in renewable energy development and increase the proportion of renewable energy in urban energy utilization. Promoting the promotion and use of clean energy can alleviate the pressure on the environment caused by urban development.

(3) From the perspective of environmental protection, the focus should be placed on areas with low coefficients of concentration. The urbanization process in these areas is slow, and no more funds are invested in environmental protection. Therefore, the government needs to formulate relevant measures to ensure that environmental maintenance and urban development are carried out simultaneously. For cities with superior basic conditions, rationally plan urban space and transportation to create favorable conditions for resource development and economic development. In addition, we must attach importance to human capital education and raise awareness of environmental protection. In regions without a rich natural resource base, it is difficult to obtain development momentum from the environment. On the one hand, it can tap its own regional characteristics, develop traditional culture according to local conditions and build a tourist city. On the other hand, development projects in these areas also need policy support to attract talent inflow and drive urban development.

Conclusions

This paper starts with the interaction between natural resources and urbanization, and builds a comprehensive system that reflects resource consumption and urbanization development. First, use the entropy method for data processing. Subsequently, the piecewise linear regression method was used to

reflect the response characteristics of the PSR system to urbanization. The Moran index is used to reflect the spatial agglomeration effect of the Chengdu-Chongqing urban agglomeration. Finally, the results of the piecewise regression are combined with the local spatial agglomeration effect to analyze. The specific conclusions of the study are as follows:

(1) There is a threshold between stress, state, and response to urbanization. According to the regression relationship of the PSR system to the U subsystem, it can be found that the main characteristics of the comprehensive utilization of natural resources in Chengdu-Chongqing area are: high pressure on resource utilization, rich resource content, and poor environmental governance. Most cities cannot effectively use resources and turn them into a driving force for urbanization. This also represents the huge potential for resource development in Chengdu-Chongqing area, and it is necessary to improve the efficiency of transforming resources into driving forces for urban development. In addition, most areas have less investment in environmental governance, or poor results. However, from the perspective of the matching phase of the use characteristics during the development of urban agglomerations, the comprehensive development level of environmental protection in Chengdu-Chongqing area is significantly higher than the utilization efficiency and development level of natural resources.

(2) Each subsystem of the PSRU system has different aggregation characteristics in space. In areas with obvious agglomeration effects, the most common features are: less pressure on natural resources, obviously insufficient resource levels, less investment in environmental protection, and higher levels of urbanization. Among them, the most important feature is the content of natural resources. Because with the development of urbanization in Chengdu-Chongqing area, changes in resource levels are more drastic than changes in resource utilization pressures and protection measures.

(3) Combining the segmented regression of the PSR system to the U subsystem and the local spatial aggregation effect of the PSRU system, the following conclusions can be drawn. In cities that meet HH and LL types, the stage where the pressure has less impact on urbanization is matched with inefficient environmental protection measures. The stage where pressure and urbanization are significantly negatively correlated with efficient and active environmental protection measures. This shows that in areas where the agglomeration effect is significant, the relationship between the pressure on the use of natural resources and environmental protection measures is matched with each other. However, regardless of the correspondence between the PR subsystems, the S subsystems may be at different stages.

(4) For areas where the comprehensive utilization of resources and the stage of urban development are not balanced, the following measures can be taken: First, in terms of energy development and utilization, improve the distribution relationship between renewable and non-renewable energy, and

encourage the use of environmentally friendly energy. The second is to increase capital investment to promote the research and promotion of new technologies for the efficient use of energy. Reduce the impact of resource utilization on urban development and cultivate diversified urban development momentum. In addition, reasonable planning of urban space and transportation to avoid ineffective and repeated use of resources. Finally, pay attention to manpower education, increase investment in environmental protection, and improve the efficiency of effective resource management.

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Appendix

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Table 2 Abbreviation of Chengyu Urban Agglomeration

City names													
Jingjiang	JJ(1)	Daan	DA	Zitong	ZT	Muchuan	MC	Jiangan	JA	Yinjing	YJ(1)	Jiangjin	JJ(3)
Qingyang	QY	Yantan	YT	Santai	ST	Ebianyi	EBY	Changning	CL	Hanyuan	HY	Hechuan	HC
Jinniu	JN	Rongxian	RX	Yanting	YT	Mabianyi	MBY	Gaoxian	GX(1)	Shimian	SM	Yongchuan	YC
Wuhou	WH	Fushun	FS	Chuanshan	CS	Shunqing	SQ	Gongxian	GX(2)	Lushan	LS	Nanchuan	NC
Chenghua	CH	Jiangyang	JY	Anjv	AJ	Gaoping	GP	Junlian	JL	Yanjiang	YJ(2)	Zuanjiang	ZJ
Longquanyi	LQY	Naxi	NX	Pengxi	PX	Jialing	JL	Xingwen	XW	Jianyang	JY	Dazu	DZ
Qingbaijiang	QBJ	Longmatan	LMT	Shehong	SH	Nanbu	NB	Pingshan	PS(2)	Anyue	AY	Bishan	BS
Xindu	XD	Luxian	LX	Daying	DY(2)	Yingshan	YS	Guangan	GA	Lezhi	LZ	Tongliang	TL
Wenjiang	WJ	Hejiang	HJ	Neijiangshizhong	NJSZ	Pengan	PA	Qianfeng	QF	Yvzhong	YZ	Tongnan	TN
Dujiangyan	DJY	Xvyong	XY	Dongxing	DX	Yilong	YL	Huaying	HY	Wanzhou	WZ	Rongchang	RC
Pengzhou	PZ	Gulin	GL	Zizhong	ZZ	Xichong	XC	Yuechi	CY	Qianjiang	QJ	Liangping	LP
Qionglai	QL	Jingyang	JY	Weiyuan	WY	Langzhong	LZ	Wusheng	WS	Fuling	FL	Fengdu	FD
Chongzhou	CZ	Guanghan	GH	Longchang	LC	Pengshan	PS(1)	Linshui	LS	Dadukou	DDK	Dianjiang	DJ
Jintang	JT	Shifang	SF	Leshanshizhong	LSSZ	Dongpo	DP	Tongchuan	TC	Jiangbei	JB	Zhongxian	ZX
Shuangliu	SL	Mianzhu	MZ	Wutongqiao	WTQ	Qingshen	QS	Dazhou	DZ(1)	Shapingba	SPB	Kaixian	KX
pidu	PD	zhongjiang	ZJ	Shawan	SW	Renshou	RS	Xuanhan	XH	Jiulongpo	JLP	Yunyang	YY
Dayi	DY(1)	Luojiang	LJ	Jinkouhe	JKH	Danling	DL	Kaijiang	KJ	Nanan	NA		
Pujiang	PJ	Fucheng	FC	Emeishan	EMS	Hongya	HY	Dazhu	DZ(2)	Beibei	BB		
Xinjin	XJ	Youxian	YX	Qianwei	QW	Cuiping	CP	Qvxian	QX	Yvbei	YB		
Ziliujing	ZLJ	Jiangyou	JY	Jingyan	JY	Nanxi	NX	Yvcheng	YC	Banan	BN		
Gongjing	GJ	Anxian	AX	Jiajiang	JJ(2)	Yibin	YB	Mingshan	MS	Changshou	CS		

Table 3 Raw data of Chengdu-Chongqing area

	P1	P2	P3	P4	S1	S2	S3	S4	R1	R2	R3	R4	U1	U2	U3	U4
JJ(1)	163.689	0.000	275.481	0.375	1133.868	0.560	15.927	6.31	95.00%	10889.881	2504.673	541.026%	125932.721	8233	0.450	0.396
QY	9.545	0.000	275.495	0.520	750.520	0.610	14.784	6.35	95.00%	11437.321	2630.584	138.095%	131535.909	9822	0.405	0.316
JN	12.833	0.000	275.492	0.627	1486.483	0.990	17.658	6.59	95.00%	13358.967	3072.562	392.500%	81052.852	6990	0.426	0.509
WH	0.426	0.000	275.491	0.808	763.460	1.120	23.839	6.86	96.00%	13705.437	3152.251	-19.231%	65177.943	8755	0.450	0.407
CH	17.472	0.000	275.493	0.623	332.166	0.990	20.218	6.51	94.00%	11406.112	2623.406	166.452%	64185.954	6623	0.417	0.506
LQY	541.969	71.076	351.035	2.804	8159.000	1.730	225.847	5.54	80.00%	16636.417	3826.376	45.109%	18023.968	1147	0.387	1.988
QBJ	388.847	4.077	773.488	0.938	32153.335	1.290	123.895	6.41	95.10%	6776.090	1558.501	1.166%	8924.963	1101	0.376	2.296
XD	498.750	2.220	535.768	1.361	20500.000	1.940	102.176	7.29	94.00%	12801.952	2944.449	2.225%	11749.395	1464	0.508	2.727
WJ	880.134	1.145	481.539	0.792	13794.190	1.370	73.223	6.67	91.00%	8206.068	1887.396	7.984%	14187.623	1484	0.419	2.044
DJY	121.373	28.626	523.315	0.430	41813.335	9.790	720.089	4.74	90.00%	7777.545	1788.835	-3.690%	2279.609	513	0.316	2.483
PZ	316.023	5.793	580.345	0.926	34200.000	9.580	648.118	6.02	86.83%	9759.000	2244.570	80.923%	2347.289	569	0.366	3.500
QL	152.358	23.938	608.866	0.500	52300.000	8.330	662.337	5.30	87.70%	7428.833	1708.632	0.069%	1482.982	478	0.371	4.027
CZ	218.382	7.895	598.281	0.506	39100.000	7.010	445.074	6.22	70.00%	7703.896	1771.896	7.476%	2076.172	615	0.405	3.901
JT	373.779	6.219	346.275	0.595	4080.000	3.850	420.206	5.39	87.00%	9113.796	2096.173	-9.835%	2466.240	772	0.440	3.629
SL	373.967	3.445	289.380	1.545	38116.030	2.260	222.037	6.92	95.54%	23884.015	5493.324	19.212%	8123.699	959	0.416	3.387
PD	742.325	1.757	507.161	0.965	19980.000	2.070	72.367	7.09	91.50%	11489.376	2642.557	-19.027%	9747.549	1260	0.430	2.807
DY(1)	134.590	7.651	440.807	0.394	21582.000	8.010	712.620	5.29	89.00%	6347.890	1460.015	-9.842%	1425.271	399	0.423	4.722
PJ	247.493	0.921	687.100	0.252	24200.000	3.340	302.180	5.16	85.30%	4161.240	957.085	12.357%	1826.329	461	0.380	3.942
XJ	354.736	7.024	566.214	0.531	14831.000	1.490	80.802	6.37	89.00%	6541.528	1504.551	4.560%	6996.401	949	0.415	3.293
ZLJ	205.208	28.760	226.830	0.740	9122.000	0.426	48.233	6.40	98.00%	691.000	283.310	5.707%	19304.377	2390	0.380	0.979
GJ	300.207	12.446	240.534	1.100	32784.000	1.055	123.000	7.21	90.00%	979.000	401.390	-13.278%	2950.034	719	0.332	3.598
DA	249.948	20.369	297.937	0.920	32705.000	1.062	99.849	6.24	88.80%	1499.000	614.590	-11.798%	4911.461	1126	0.488	3.882

YT	276.350	38.249	214.481	0.750	44656.000	1.273	111.622	6.46	88.50%	2857.000	1171.370	-16.539%	2557.885	833	0.389	4.719
RX	219.486	35.693	362.274	3.440	100807.000	4.983	656.445	5.71	85.60%	7815.000	3204.150	-1.900%	1159.665	427	0.097	1.553
FS	226.698	42.071	251.826	1.520	91395.000	3.494	472.384	5.74	82.00%	9032.000	3703.120	-18.544%	1652.651	807	0.171	1.790
JY	268.755	19.682	244.208	1.784	27742.300	3.626	247.065	3.98	90.19%	2655.000	1008.900	-0.464%	6156.242	934	0.399	3.601
NX	152.790	15.788	244.208	2.571	29292.900	6.380	628.261	7.45	90.19%	4387.000	1667.060	-0.383%	1079.479	401	0.399	6.695
LMT	216.882	19.476	244.208	5.592	10940.001	1.858	95.209	4.20	79.00%	4987.000	1895.060	-6.982%	5712.049	1081	0.399	3.439
LX	255.103	11.441	244.208	3.442	74500.000	8.722	623.916	4.81	90.19%	5919.000	2249.220	-17.900%	1626.503	566	0.380	10.919
HJ	125.920	9.221	244.208	1.619	81033.337	13.954	1328.019	3.87	90.19%	7362.000	2797.560	-8.627%	669.859	294	0.340	14.482
XY	58.510	9.684	244.208	0.794	83640.004	16.176	1641.576	6.78	83.00%	14563.000	5533.940	-5.029%	337.098	195	0.275	20.253
GL	57.957	5.651	244.208	2.462	62695.500	13.775	1605.265	3.60	85.00%	9251.000	3515.380	-5.590%	402.118	221	0.343	28.411
SY	312.703	3.990	540.396	3.559	55274.000	2.415	138.659	4.30	91.50%	3000.000	780.000	8.285%	7037.865	1068	0.401	8.146
GH	470.389	3.494	572.774	3.402	72612.000	2.038	91.630	4.70	67.90%	3624.000	942.240	6.482%	5903.765	1106	0.408	4.087
SF	309.432	5.261	584.424	1.927	47799.000	4.310	306.792	4.80	87.00%	6053.000	1573.780	-2.442%	2850.472	530	0.460	3.679
MZ	183.276	8.175	592.855	2.305	57972.000	7.000	635.470	4.20	91.60%	4121.000	1071.460	9.471%	1728.482	404	0.394	2.423
ZJ	234.127	23.713	275.645	1.878	180815.000	6.530	893.362	4.60	64.10%	3244.000	843.440	7.945%	1308.608	642	0.352	2.307
LJ	274.048	7.085	530.730	0.991	37610.000	1.808	177.670	3.50	63.60%	2524.000	656.240	0.518%	1964.458	557	0.319	2.125
FC	346.222	19.163	373.274	0.329	33041.000	2.473	143.106	4.18	92.74%	2113.000	52.163	16.068%	11316.055	500	0.387	5.738
YX	224.911	12.905	346.595	0.230	56514.000	1.488	304.731	4.18	92.74%	3257.000	80.404	-0.979%	1853.274	209	0.387	12.943
JY	136.197	6.635	585.117	2.437	86400.000	11.173	1281.191	4.00	88.01%	7998.000	197.443	-47.278%	1186.479	115	0.420	19.391
AX	196.051	9.824	409.439	2.784	64703.000	12.762	422.376	4.23	95.86%	5665.000	139.849	-64.835%	929.102	162	0.360	14.240
ZT	151.495	10.915	401.022	0.305	68468.000	5.666	607.890	4.49	65.75%	4597.000	113.484	-10.421%	590.753	102	0.360	20.413
ST	229.343	11.672	284.793	0.514	196007.000	6.302	1013.224	3.86	69.94%	7310.000	180.459	691.388%	771.608	210	0.400	11.805
YT	171.328	11.256	234.313	0.157	82456.000	2.039	927.763	4.44	47.06%	3975.000	98.129	27.624%	524.022	151	0.405	11.703
CS	206.451	15.901	275.525	1.290	60466.000	1.724	238.388	3.85	100.00%	5347.000	3422.080	41.681%	4191.605	1167	0.356	32.402

AJ	273.827	20.482	211.173	1.010	132570.000	3.423	451.874	3.59	31.58%	7376.000	4720.640	1.663%	916.056	637	0.051	0.673
PX	204.197	16.807	152.381	1.210	120243.000	2.903	501.651	3.49	54.03%	3641.000	2330.240	1.854%	957.630	570	0.363	8.055
SH	185.898	14.162	258.129	1.660	129543.000	3.919	625.328	3.51	78.32%	4652.000	2977.280	-16.237%	1956.204	669	0.286	12.048
DY(2)	155.675	20.181	315.816	1.560	80277.000	1.399	243.247	3.84	87.69%	4010.000	2566.400	-7.201%	1853.424	789	0.297	9.656
NJSZ	273.614	7.935	248.992	0.780	35917.000	0.757	104.666	4.02	89.01%	1806.000	38.214	-1.775%	5571.559	2307	0.354	9.260
DX	320.411	25.897	175.527	1.030	105461.000	2.647	312.736	4.58	89.08%	1884.000	39.865	-0.954%	1855.712	1054	0.367	9.800
ZZ	300.681	23.049	174.836	2.460	147882.000	3.533	606.539	4.26	86.67%	7215.000	152.666	103.928%	1361.730	2175	0.242	6.250
WY	270.113	16.453	269.953	3.500	95018.000	2.886	517.534	4.23	79.73%	7416.000	156.919	-66.193%	2284.179	3557	0.322	8.240
LC	256.769	21.106	217.870	1.270	65142.000	1.990	243.804	5.05	97.01%	3498.000	74.016	-3.598%	2933.541	3772	0.390	10.850
LSSZ	170.110	12.671	423.189	0.815	34651.898	6.220	306.175	4.70	80.20%	2583.000	710.758	6.405%	3412.069	737	0.371	6.734
WTQ	190.475	6.787	536.715	2.549	27812.918	3.400	166.145	4.90	75.46%	2314.000	636.738	-12.914%	2938.604	666	0.268	2.080
SW	91.150	17.993	568.577	1.569	14357.895	5.020	339.178	5.50	75.46%	6905.000	1900.034	-9.588%	2868.653	302	0.295	2.161
JKH	23.525	7.575	342.592	2.524	3548.308	3.750	329.259	5.80	90.00%	2555.000	703.054	-3.639%	533.833	85	0.091	1.539
EMS	110.993	7.440	366.585	3.074	31511.814	12.310	735.999	4.00	80.20%	7819.000	2151.537	1.440%	1786.913	365	0.446	5.483
QW	130.025	11.532	347.334	2.419	79011.473	10.240	600.087	4.80	87.00%	6560.000	1805.101	-4.182%	976.133	416	0.330	2.377
JY	151.076	8.401	310.481	2.869	70636.825	3.550	232.008	4.40	95.00%	4748.000	1306.497	4.387%	961.917	489	0.181	0.849
JJ(2)	220.179	18.221	623.035	2.652	36214.737	6.160	276.768	5.50	75.46%	2395.000	659.027	-19.945%	1686.546	468	0.185	2.115
MC	81.214	23.087	198.366	1.795	25502.050	13.490	1001.203	4.20	96.00%	5790.000	1593.221	-14.146%	387.811	182	0.352	2.059
EBY	9.154	3.645	178.899	1.784	12990.492	18.170	1812.940	5.10	57.50%	11594.000	3190.295	4.437%	148.447	62	0.106	0.398
MBY	28.450	5.402	178.106	1.696	21285.590	21.780	1252.437	4.60	82.80%	8585.000	2362.315	-23.665%	139.884	94	0.174	0.970
SQ	292.589	8.204	193.243	0.190	26620.000	1.516	139.551	4.39	86.50%	3215.000	278.691	-4.123%	391.799	1311	0.431	12.100
GP	241.733	8.306	165.574	0.230	35494.000	1.944	307.892	5.00	80.00%	3909.000	338.850	-8.729%	323.174	749	0.431	12.100
JL	198.375	19.755	157.322	0.170	66552.000	4.139	349.216	3.80	86.50%	3656.000	316.919	-1.074%	282.485	523	0.431	12.100
NB	177.530	17.906	182.370	0.160	107293.000	6.195	1065.940	4.60	83.00%	5026.000	435.676	0.000%	241.046	419	0.378	8.700

YS	173.972	4.465	156.003	0.150	64655.000	4.558	576.665	3.95	83.30%	5055.000	438.190	-8.609%	230.546	454	0.376	8.500
PA	208.244	6.243	148.234	0.160	59987.000	3.949	422.060	4.24	76.30%	5180.000	449.026	-4.978%	269.860	428	0.366	8.700
YL	202.644	8.108	128.381	0.100	83714.000	4.164	625.337	4.74	83.00%	7808.000	676.833	52.533%	305.240	524	0.369	9.000
XC	212.248	6.464	172.304	0.080	73243.000	3.303	498.150	3.80	85.10%	4671.000	404.903	1.496%	270.777	478	0.374	9.000
LZ	161.034	16.034	184.777	0.140	69296.000	8.200	649.500	4.67	85.92%	8218.000	712.374	0.903%	231.606	389	0.427	10.500
PS(1)	296.215	12.526	420.591	1.643	16848.895	5.407	512.316	4.77	84.60%	8650.864	1730.173	-7.966%	2644.596	665	0.397	20.055
DP	31.696	2.224	486.191	1.609	5439.419	1.800	952.181	5.00	45.00%	5870.003	1174.001	-0.977%	473.249	711	0.239	11.765
QS	162.245	14.532	439.403	0.523	3609.183	1.876	178.833	3.81	85.00%	3448.648	689.730	45.399%	1678.106	510	0.364	15.582
RS	1229.463	53.443	296.004	2.333	30730.694	9.699	170.175	4.71	85.00%	13598.890	2719.778	-3.606%	7273.186	604	0.328	5.855
DL	192.244	12.578	253.073	0.289	3949.701	2.458	268.065	4.41	87.00%	2938.093	587.619	8.557%	1112.076	363	0.443	17.039
HY	56.737	11.019	369.411	0.395	4884.872	22.431	1347.580	4.35	84.60%	4664.295	932.859	8.659%	527.211	185	0.420	13.375
CP	163.854	3.568	335.235	0.153	48335.000	5.977	464.841	4.11	78.00%	4022.000	872.636	11.434%	4524.038	754	0.382	2.986
NX	254.072	15.632	328.540	0.203	52231.000	2.513	310.957	4.65	94.00%	4226.000	916.897	5.263%	1529.815	484	0.382	4.405
YB	113.105	5.300	286.525	0.165	113075.000	17.013	1186.878	5.59	71.94%	7708.000	1672.371	0.850%	739.153	263	0.360	8.177
JA	202.639	16.507	254.076	0.364	47401.000	4.868	326.668	5.61	89.00%	4086.000	886.522	122.652%	1371.115	467	0.400	5.441
CL	155.889	48.414	267.929	1.635	48121.000	6.187	564.732	5.18	85.84%	5185.000	1124.967	123.645%	1096.626	346	0.415	5.197
GX(1)	117.647	7.128	216.061	0.610	56895.000	7.206	605.220	4.63	75.00%	6417.000	1392.269	-0.312%	855.486	314	0.382	6.595
GX(2)	105.547	7.121	224.325	1.025	46824.000	7.737	579.714	5.66	85.00%	4118.000	893.465	6.107%	1072.583	327	0.382	5.774
JL	110.127	11.128	354.905	0.558	42452.000	12.769	612.677	4.10	80.75%	25697.000	5575.367	-6.001%	882.810	265	0.345	6.677
XW	97.368	10.767	225.842	0.468	47997.000	9.793	662.814	5.11	100.00%	6538.000	1418.522	79.263%	585.565	280	0.390	7.237
PS(2)	85.639	13.417	260.359	0.684	40673.000	12.577	791.104	5.54	85.00%	5624.000	1220.215	-30.766%	266.369	170	0.397	11.051
GA	215.910	18.111	174.806	0.741	79225.000	6.496	395.703	4.70	100.00%	5892.925	1687.532	50.799%	1409.418	599	0.420	4.313
QF	250.557	20.944	316.776	3.572	33614.000	4.897	262.657	4.70	96.55%	2631.014	753.432	2.000%	2980.935	507	0.400	3.788
HK	178.666	17.210	262.481	2.301	29705.000	4.480	220.712	4.92	97.10%	3733.420	1069.124	-5.585%	2898.766	610	0.380	3.266

CY	226.724	8.295	155.692	1.153	130999.000	7.406	492.604	4.54	90.00%	7076.379	2026.433	6.122%	1278.046	533	0.320	4.011
WS	292.419	13.933	183.368	1.085	91052.000	6.534	377.438	4.00	86.20%	5721.773	1638.520	-5.519%	1980.137	618	0.363	3.556
LS	196.820	9.918	221.167	1.051	123234.000	9.537	784.632	4.30	87.00%	6423.130	1839.365	-4.798%	1034.582	374	0.395	6.216
TC	209.485	11.579	160.009	2.473	53421.000	6.483	314.352	6.38	52.86%	616.770	343.770	-44.915%	2234.009	673	0.350	3.171
DZ(1)	190.632	10.537	156.221	2.457	139994.000	10.199	727.380	6.50	82.00%	12841.286	3771.365	10.400%	1001.725	527	0.350	5.205
XH	117.566	6.498	239.393	2.850	163316.000	15.774	2563.200	3.62	83.05%	14360.000	4217.397	-9.880%	525.055	304	0.322	5.343
KJ	260.300	14.388	252.907	2.640	74177.000	7.277	381.470	3.43	85.00%	6389.626	1876.573	-10.344%	1011.133	573	0.361	5.214
DZ(2)	234.053	12.937	177.745	2.589	151682.000	10.106	838.045	4.24	84.00%	10693.030	3140.442	-13.406%	1265.078	529	0.330	4.609
QX	257.335	14.224	128.045	2.834	159745.000	9.256	726.480	3.61	52.86%	12395.552	3640.457	-7.095%	1079.323	677	0.372	4.252
YC	127.450	25.476	108.023	0.290	19438.000	11.587	666.395	4.37	85.15%	4425.400	1060.196	7.112%	1317.498	323	0.426	24.563
MS	245.123	48.997	98.566	1.470	28659.000	7.696	296.640	5.10	85.15%	3107.360	744.432	-2.206%	989.644	451	0.361	12.673
YJ(1)	31.651	6.327	297.850	1.400	18755.000	13.141	1362.781	3.70	100.00%	5808.400	1391.522	-4.625%	345.132	84	0.362	12.011
HY	51.423	10.279	148.182	0.640	44231.000	13.794	1224.895	3.60	85.00%	3129.860	749.822	-5.353%	285.914	145	0.381	3.648
SM	17.957	3.589	429.367	1.710	11691.000	16.051	1702.505	3.20	86.00%	2797.660	670.237	46.246%	261.292	46	0.380	10.415
LS	39.279	7.851	297.170	0.580	14558.000	10.502	914.212	3.60	85.00%	5147.260	1233.132	-24.281%	270.949	102	0.269	10.936
YJ(2)	267.865	21.860	22.520	0.968	186648.000	4.250	466.846	4.00	86.58%	2901.000	751.239	2.120%	2513.952	677	0.387	15.301
JY	198.040	13.533	12.762	0.987	215909.000	5.127	836.924	4.42	85.03%	11204.000	2901.374	8.213%	1813.282	672	0.367	6.894
AY	255.171	13.877	8.184	0.960	206029.000	5.951	1148.545	4.01	86.00%	8278.000	2143.661	-3.306%	1043.200	598	0.185	2.823
LZ	145.160	12.091	9.968	0.923	127799.000	3.923	588.327	2.00	86.58%	3335.000	863.627	-12.160%	1250.246	588	0.411	14.530
YZ	0.000	0.000	110.808	0.101	0.000	0.103	10.670	5.56	93.50%	5306.746	3944.896	0.000%	404122.000	27394	0.398	6.800
WZ	166.588	10.142	240.652	0.248	178657.000	16.701	1662.519	4.68	91.00%	9154.512	6805.225	-2.314%	2396.206	470	0.367	11.570
QJ	56.066	7.082	248.497	0.149	85128.000	13.899	1345.120	3.82	93.70%	3910.709	2907.119	-8.790%	843.256	194	0.435	38.000
FL	166.381	10.709	437.938	0.271	180316.000	15.746	1353.476	4.96	90.00%	9113.616	6774.824	1.518%	2763.753	390	0.415	66.357
DDK	178.820	20.423	225.428	0.220	1683.000	0.461	41.068	5.66	91.00%	1903.543	1415.044	128.900%	15556.560	3240	0.440	17.300

JB	29.731	18.934	204.017	0.024	1531.000	0.805	45.479	4.77	95.00%	7708.766	5730.495	443.000%	31132.400	3902	0.428	21.040
SPB	146.348	2.828	186.163	0.016	7485.000	1.431	108.955	5.46	94.50%	6724.778	4999.024	155.389%	18028.773	2862	0.359	49.086
JLP	238.709	3.725	219.096	0.085	11130.000	1.373	175.758	4.88	97.00%	7079.321	5262.582	45.470%	23296.578	2790	0.427	14.840
NA	215.753	5.648	211.489	0.040	2159.000	1.330	110.221	5.16	93.67%	8068.140	5997.644	130.949%	25888.046	3330	0.436	12.400
BB	232.187	3.630	302.913	0.110	29674.000	3.794	367.534	4.75	87.80%	3763.145	2797.423	-11.546%	5699.868	1041	0.388	17.800
YB	172.612	10.217	171.239	0.017	60652.000	6.320	566.280	5.03	85.00%	7185.974	5341.865	-8.551%	8218.595	1104	0.455	18.000
BN	255.914	5.617	203.111	0.047	88244.000	8.204	793.701	5.09	95.00%	4503.391	3347.703	1.126%	3114.874	576	0.408	22.900
CS	205.687	6.335	439.361	0.954	91069.000	5.936	642.053	5.41	91.50%	4263.977	3169.729	-7.908%	3021.312	580	0.439	19.950
JJ(3)	226.358	5.312	646.893	0.290	154519.000	16.569	1360.187	6.15	93.50%	6948.029	5164.983	-23.237%	1892.209	423	0.321	13.350
HC	256.785	9.245	225.109	0.478	174296.000	9.789	489.687	5.23	91.00%	5212.850	3875.097	-1.801%	2032.394	587	0.421	16.110
YC	231.832	10.622	284.765	0.167	106982.000	8.340	732.840	5.21	82.32%	5783.494	4299.298	-11.130%	3618.909	705	0.421	23.300
NC	123.220	8.696	321.551	0.511	106693.000	13.590	1287.990	5.00	91.00%	3430.411	2538.504	-5.020%	715.796	220	0.359	10.310
ZJ	222.491	18.458	235.103	0.712	123920.000	11.718	918.681	5.60	73.60%	5765.875	4286.201	-26.252%	1732.428	497	0.399	10.310
DZ	245.859	16.330	230.210	0.079	108328.000	7.403	624.660	4.42	90.00%	5066.640	3766.408	-7.089%	2431.546	543	0.449	14.110
BS	161.978	4.353	168.105	0.053	55428.000	4.103	454.536	6.16	93.67%	5134.385	3816.767	-17.866%	4174.248	793	0.490	13.980
TL	188.763	6.706	294.786	0.113	118202.000	6.229	647.442	4.58	97.50%	3508.193	2607.899	-15.472%	2299.211	537	0.424	22.670
TN	298.138	14.352	272.529	0.075	148873.000	6.319	712.350	4.40	94.00%	3676.162	2732.762	1.922%	1675.300	445	0.400	36.000
RC	345.229	16.761	242.028	0.108	78423.000	3.611	372.211	5.12	93.67%	3544.632	2634.987	8.438%	3062.860	654	0.450	11.000
LP	168.295	9.194	250.031	0.188	102579.000	7.666	832.537	4.48	80.00%	4025.866	2992.723	-21.217%	1280.726	345	0.380	17.170
FD	70.496	8.130	215.186	1.106	112471.000	12.513	1293.846	5.01	95.00%	3736.051	2777.283	-15.715%	517.718	202	0.389	18.520
DJ	202.864	6.790	288.014	0.242	90951.000	6.113	652.740	4.68	89.10%	3156.696	2346.605	45.403%	1579.974	453	0.351	10.950
ZX	145.896	6.047	197.168	0.724	109123.000	8.825	1100.061	3.75	98.00%	3671.323	2729.166	-11.286%	1016.918	328	0.398	1.941
KX	120.377	6.160	254.414	0.291	181066.000	18.599	1882.425	4.63	90.00%	5429.642	4036.254	-10.552%	822.559	296	0.417	12.750
YY	101.333	7.171	173.477	0.071	133818.000	16.249	1824.500	3.79	83.00%	4676.054	3476.057	-9.330%	514.963	250	0.411	15.000

Table 5 Assessment results of PSRU in Chengdu-Chongqing Economic Circle

	P	S	R	U		P	S	R	U		P	S	R	U
JJ(1)	0.115	0.036	0.551	0.276	FS	0.345	0.266	0.384	0.045	SH	0.248	0.398	0.295	0.119
QY	0.099	0.035	0.423	0.286	JY	0.286	0.196	0.189	0.113	DY(2)	0.272	0.246	0.283	0.111
JN	0.107	0.036	0.556	0.224	NX	0.303	0.187	0.243	0.118	NJSZ	0.181	0.155	0.124	0.142
WH	0.116	0.03	0.421	0.237	LMT	0.52	0.128	0.242	0.114	DX	0.251	0.287	0.125	0.132
CH	0.107	0.036	0.431	0.206	LX	0.359	0.347	0.285	0.135	ZZ	0.329	0.398	0.217	0.097
LQY	0.607	0.103	0.486	0.114	HJ	0.214	0.521	0.333	0.138	WY	0.390	0.306	0.149	0.141
QBJ	0.325	0.099	0.269	0.105	XY	0.152	0.514	0.548	0.148	LC	0.249	0.202	0.154	0.172
XD	0.304	0.067	0.405	0.145	GL	0.244	0.528	0.385	0.202	LSSZ	0.226	0.227	0.158	0.117
WJ	0.312	0.062	0.297	0.122	SY	0.422	0.201	0.184	0.137	WTQ	0.347	0.162	0.137	0.069
DJY	0.271	0.326	0.282	0.081	GH	0.444	0.206	0.162	0.119	SW	0.317	0.166	0.255	0.072
PZ	0.271	0.273	0.352	0.098	SF	0.333	0.219	0.248	0.121	JKH	0.274	0.126	0.169	0.016
QL	0.29	0.302	0.272	0.1	MZ	0.349	0.318	0.212	0.098	EMS	0.328	0.363	0.289	0.124
CZ	0.24	0.221	0.253	0.11	ZJ	0.308	0.506	0.148	0.089	QW	0.300	0.371	0.266	0.081
JT	0.203	0.148	0.306	0.119	LJ	0.261	0.191	0.127	0.08	JY	0.311	0.245	0.235	0.039
SL	0.24	0.118	0.666	0.118	FC	0.235	0.173	0.139	0.119	JJ(2)	0.421	0.206	0.137	0.046
PD	0.309	0.069	0.364	0.123	YX	0.18	0.211	0.146	0.142	MC	0.257	0.393	0.257	0.082
DY(1)	0.18	0.26	0.246	0.115	JY	0.343	0.485	0.177	0.178	EBY	0.17	0.498	0.351	0.014
PJ	0.225	0.164	0.198	0.102	AX	0.343	0.378	0.156	0.141	MBY	0.173	0.509	0.304	0.033
XJ	0.253	0.073	0.255	0.116	ZT	0.179	0.306	0.116	0.168	SQ	0.133	0.146	0.146	0.16
ZLJ	0.237	0.047	0.143	0.121	ST	0.179	0.556	0.399	0.139	GP	0.121	0.167	0.145	0.154
GJ	0.22	0.077	0.133	0.092	YT	0.133	0.315	0.094	0.139	JL	0.15	0.273	0.154	0.151
DA	0.243	0.099	0.149	0.137	CS	0.238	0.221	0.381	0.236	NB	0.145	0.414	0.169	0.122
YT	0.281	0.114	0.192	0.112	AJ	0.232	0.375	0.353	0.008	YS	0.089	0.296	0.167	0.121
RX	0.47	0.318	0.355	0.022	PX	0.205	0.359	0.217	0.117	PA	0.1	0.258	0.159	0.119

	P	S	R	U
YL	0.097	0.304	0.229	0.122
XC	0.102	0.288	0.168	0.123
LZ	0.135	0.339	0.221	0.141
PS(1)	0.298	0.211	0.277	0.183
DP	0.233	0.19	0.16	0.105
QS	0.217	0.136	0.187	0.152
RS	0.61	0.251	0.384	0.104
DL	0.154	0.138	0.166	0.176
HY	0.162	0.51	0.199	0.151
CP	0.129	0.275	0.18	0.103
NX	0.188	0.207	0.207	0.105
YB	0.115	0.549	0.248	0.114
JA	0.175	0.208	0.237	0.113
CL	0.368	0.262	0.257	0.114
GX(1)	0.134	0.305	0.224	0.112
GX(2)	0.160	0.269	0.191	0.109
JL	0.178	0.369	0.657	0.103
XW	0.137	0.32	0.293	0.117
PS(2)	0.167	0.347	0.211	0.134
GA	0.188	0.304	0.292	0.114
QF	0.419	0.204	0.185	0.107
HK	0.300	0.184	0.212	0.101
CY	0.175	0.405	0.292	0.088
WS	0.209	0.337	0.246	0.098

	P	S	R	U
LS	0.186	0.457	0.266	0.114
TC	0.27	0.217	0.058	0.094
DZ(1)	0.261	0.429	0.436	0.101
XH	0.28	0.799	0.471	0.092
KJ	0.322	0.337	0.263	0.104
DZ(2)	0.291	0.513	0.374	0.093
QX	0.303	0.517	0.373	0.103
YC	0.155	0.320	0.204	0.206
MS	0.332	0.227	0.17	0.137
YJ(1)	0.188	0.429	0.255	0.13
HY	0.12	0.462	0.169	0.096
SM	0.228	0.504	0.181	0.126
LS	0.142	0.345	0.21	0.102
YJ(2)	0.187	0.455	0.172	0.158
JY	0.144	0.537	0.375	0.115
AY	0.152	0.576	0.301	0.05
LZ	0.126	0.429	0.178	0.159
YZ	0.031	0.047	0.385	0.700
WZ	0.136	0.712	0.579	0.134
QJ	0.102	0.529	0.31	0.268
FL	0.188	0.662	0.576	0.397
DDK	0.169	0.055	0.25	0.217
JB	0.122	0.081	0.666	0.25
SPB	0.078	0.087	0.514	0.342

	P	S	R	U
JLP	0.108	0.113	0.498	0.204
NA	0.107	0.086	0.573	0.202
BB	0.129	0.194	0.292	0.176
YB	0.105	0.285	0.466	0.196
BN	0.111	0.371	0.346	0.198
CS	0.222	0.323	0.325	0.192
JJ(3)	0.230	0.607	0.461	0.131
HC	0.158	0.48	0.375	0.169
YC	0.153	0.391	0.388	0.205
NC	0.160	0.521	0.282	0.123
ZJ	0.203	0.468	0.368	0.136
DZ	0.157	0.389	0.364	0.167
BS	0.084	0.210	0.370	0.180
TL	0.131	0.387	0.293	0.200
TN	0.169	0.443	0.302	0.254
RC	0.180	0.253	0.297	0.154
LP	0.131	0.404	0.290	0.161
FD	0.161	0.516	0.301	0.167
DJ	0.141	0.344	0.283	0.127
ZX	0.137	0.475	0.303	0.095
KX	0.120	0.764	0.382	0.149
YY	0.086	0.681	0.364	0.157