Ecological Indicators 87 (2018) 47–55

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

Land use policy as an instrument of rural resilience – The case of land withdrawal mechanism for rural homesteads in China

Xianjin Huang[a,b], Huan Li[c,b,d,*], Xiaoling Zhang[d,**], Xin Zhang[a,b]

[a] Geographic and Oceanographic Sciences School, Nanjing University, Nanjing 210093, China
[b] Key Laboratory of Coastal Zone Exploitation and Protection, Ministry of Land and Resources, China
[c] Department of Land Management, Zhejiang University, Hangzhou 310058, China
[d] Department of Public Policy, City University of Hong Kong, Hong Kong, China; Shenzhen Research Institute, City University of Hong Kong, Shenzhen, China

ARTICLE INFO

Keywords:
Rural sustainability
Rural development
Land market
Government regulations
Assessment index

ABSTRACT

Resilience has emerged as an attractive conceptual approach for theorizing rural development in terms of highly complex, vulnerable and adaptive systems. In China, land use policies have evidently influenced rural resilience. We conduct a co-citation analysis, especially the visualization of co-citation networks and research clusters, using CiteSpace 4.0.R5. Based on the analysis and literature review, we develop an assessment index system comprising four types of resilience – engineering, ecological, economic and social – to evaluate the changes in rural resilience resulting from a policy to develop a withdrawal mechanism for rural homesteads (WMRH). Our findings indicate that rural resilience in Guangzhou, Chongqing and Wuxi, selected as the study areas, increased by 123%, 61% and 88% respectively after the implementation of the policy. The main causes of these variations in changes in rural resilience are attributed to the diverse economic development modes in the different regions, as well as differing degrees of land market development and government regulation. Overall, the implementation of a WMRH, accompanied by a strong market and government regulation, is found to be optimal for enhancing rural resilience. We conclude that improving rural resilience involves appropriate government regulations as well as simply paying attention to the effects of the market on the optimal allocation of resources.

1. Introduction

Rural resilience entails a process of sustained monitoring, facilitation, maintenance and recovery of virtual cyclic interactions between ecosystem services and human well-being under the influence of external factors. Although connected, rural resilience and rural sustainability entail differences, including the scales at which they are applied (Olsson et al., 2015). Therefore, they cannot be substituted for each other (Fig. 1). Rural development that is rational and achievable must be both resilient and sustainable. There has been a meteoric rise in the prioritization and application of resilience within planning and management, as evidenced in regional studies. These studies indicate that the resilience agenda has been widely adopted by NGOs, governments, planners, managers, architects, designers, social scientists, ecologists and engineers (McPhearson, 2014). Thus, there has been an explosion in the popularity of resilience within both academic and policy discourses and numerous explanations have been offered for this dramatic rise (Meerow and Baud, 2012). In particular, the concept of resilience is appealing in rural development theorizing in terms of highly complex, vulnerable and adaptive systems.

Rural resilience in the context of poverty, which is also governed by land use policies in rural context. The sustainable and resilient rural studies dealing with rural poverty, climate change adaptation through rural development program (Gerlitz et al., 2017). Rural areas in developing countries are largely expected to be disproportionally hurt by projected changes in temperature, precipitation, and extreme events (Skjeflo, 2013). The actual land use policy level response to these changes is not well understood. There is confusion about the kinds of policy problems to be solved by means of indicators worldwide(Hinkel, 2011). However, indicates can reflect some parts of the actual situation of rural poverty context and improve understanding of the environmental and socio-economic changes affecting rural livelihoods (Pandey et al., 2017). How policies can affect rural resilience is and will be a hot research topic.

Land use policies in China have had a significant influence on rural resilience, with the establishment of a leasehold property rights system and wide array of frequently

changing policies (Salant and Yu, 2016). Urban land in China is owned by the state, while rural land is jointly owned by rural collectives (i.e., communities residing in the same village) (Huang et al.,

* Corresponding author at: Department of Public Policy, City University of Hong Kong, Hong Kong, China.
** Corresponding author.
E-mail addresses: lihuan2039@163.com (H. Li), xiaoling.zhang@cityu.edu.hk (X. Zhang).

https://doi.org/10.1016/j.ecolind.2017.12.043
Received 19 February 2017; Received in revised form 27 October 2017; Accepted 18 December 2017
Available online 22 December 2017
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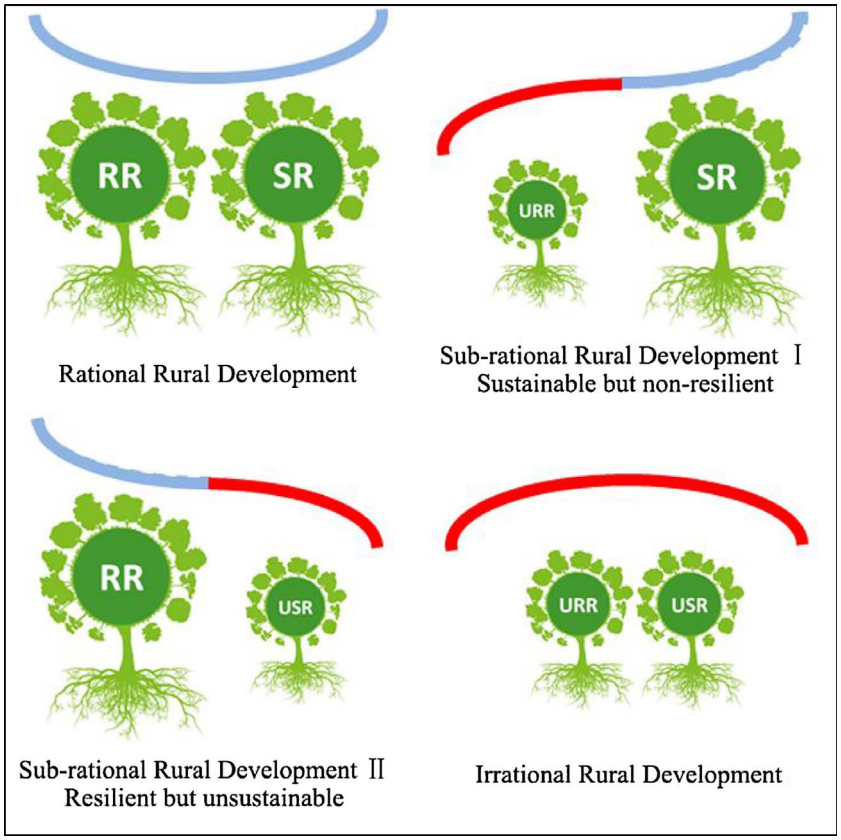

Fig. 1. Rural resilience and rural sustainability.
Notes: The abbreviations RR, SR, URR and USR denote resilient rural, sustainable rural, non-resilient rural and unsustainable rural, respectively. If rural development is sustainable and resilient, it is a rational rural system. The concave blue line indicates that rational rural development is non-convergent, which means that this form of development facilitates rural sustainability and the implemented form of development is one of the potential forms of development, which is non-convergent. If rural development is unsustainable and non-resilient, it is an irrational rural system. The convex red line indicates that irrational rural development is convergent, which implies the eventual destruction of the rural environment and makes the rural system unsustainable. Between these two extremes of rational and irrational rural development exists two types of sub-rational rural development: sustainable but unresilient, and resilient but unsustainable.

2014). Land transactions entail exchanges of leases for land use rights, with terms ranging from 40 years for commercial land to 70 years for residential land (Krusekopf, 2002) and legal land tenure security has been improved during recent land tenure reforms (Ma et al., 2015). The central government controls the overall allocation of land use rights at the national level, while local governments contract-out land use rights through negotiations, tenders and auctions (Xu et al., 2016). Land use policies – for example, the withdrawal mechanism for rural homesteads (WMRH), which allows rural homesteads to be transferred by compensation and auction – significantly influence changes in rural resilience under this system (Zhang et al., 2006).

Withdrawal mechanism for rural homesteads(WMRH) refers to a type of rural construction land circulation that farmers completely abandon land use rights for better welfare compensation. The establishment of such mechanism, which based on the incentive and restraint rules, is an important way to improve the management system of rural residential land (Li et al., 2014). Homestead withdrawal mechanisms are being formulated aimed at improving rural resilience based on regional characteristics entailing differences in modes of economic development, degrees of development of the land market and government regulations. Varying levels of economic development and differences in regional cultures and environments in eastern, western and southern regions of China directly affect farmers' land-use behavior patterns, as well as the dynamics between farmers, governments and enterprises. These differences are among the most important factors affecting variations in changes in the rural resilience of areas where the policy has been implemented.

It is necessary to carry out quantitative research analyzing the relationship between rural resilience and land use policy. Thus we apply bibliometric analysis in a review of the academic literature concerning rural resilience published over the last four decades for an improved understanding of what rural resilience entails and how it is affected by land use policies. The withdrawal mechanism for rural homesteads (WMRH) in China is then introduced in detail for international readers, and an assessment index system is developed to evaluate changes in rural resilience resulting from the implementation of the WMRH policy based on the analysis of research clusters of rural resilience and the introduction of WMRH. Tianhe in Guangzhou City, Shizhu in Chongqing City and Huishan in Wuxi city are used in an empirical study of the characteristics of the WMRH and how the WMRH has affected rural resilience. Finally, some policy suggestions are introduced for reference by policy makers.

2. Literature review

2.1. Rural resilience and its research clusters

In this study, we conduct a co-citation analysis, especially the visualization of co-citation networks and research clusters, using CiteSpace 4.0.R5. The Science Citation Index and the Social Sciences Citation Index, included in the Database of the Web of Science™ Core Collection, are used to identify the rural resilience literature. The search topic "rural resilience" yields 816 hits. We subsequently review the titles and abstracts of these studies to determine whether they were actually relevant to the study of rural resilience. This results in 500 articles ultimately being selected for importing into CiteSpace for visualizing and analyzing the co-citation network and obtaining the literature clusters. In this way, 29 co-citation clusters are identified within the network. These are labeled using index terms provided by the citers. Fig. 2 depicts the five largest clusters (rural community, rural governance, development policies, rural building and climate change) within the network.

Within the rural resilience literature, the topic of rural communities has evidently attracted the most attention. For instance, the development of a conceptual framework for understanding the trajectories of rural communities, based on the economic, social, and environmental resilience and vulnerability of rural areas, has been widely discussed, arguing that policy implications are always associated with a transition

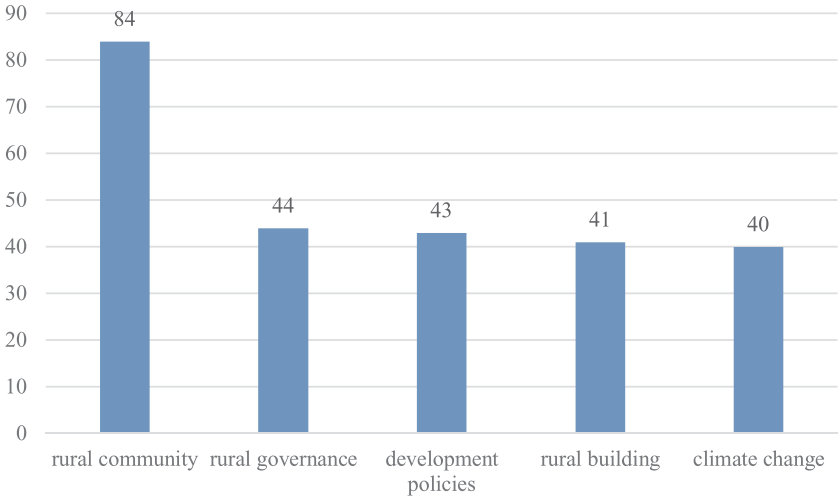

Fig. 2. Five largest clusters of rural resilience.
Note: The five columns represent five clusters numbered in descending order of cluster size from the output of CiteSpace. In general, clusters with more components and a stronger silhouette appear at the center of the network. Rural community (#1) has 84 members and a silhouette value of 0.887. Rural governance (#2) has 44 members and a silhouette value of 0.962. Development policies (#3) has 43 members and a silhouette value of 1. Rural building (#4) has 41 members and a silhouette value of 0.993. Climate change (#4) has 40 members and a silhouette value of 0.966.

from weak to strong multi-functionality (Wilson, 2010). Other studies reveal that social processes are important factors influencing rural communities' ability to cope with changes in the Solomon Islands (Schwarz et al., 2011), and the local economy, environment and a strong sense of belonging contributed to the potential for resilience in Australia (Mcmanus et al., 2012). Other popular topics within the field of rural resilience include rural governance and development policies. In particular, many studies focus on how governments' financial investments aimed at strengthening public values in relation to social-ecological systems can contribute to the resilience of rural systems (Schouten et al., 2013). Additionally, in order to obtain a deeper understanding of the governance of rural change, the degree of resilience of a European rural development policy is investigated (Schouten et al., 2012) and a rural diversity index used to assess the diversity and resilience of rural socio-ecological systems – indicating that higher natural-socio-economic diversity lead to a higher degree of rural development in Southern Italy (Quaranta and Salvia, 2014). Building resilience is another important research direction of these studies. Most building resilience studies adopt sectoral, spatial and socio-governmental entry points to explore the connections, interdependencies and tensions between social resilience and market imperatives (Rigg and Oven, 2015). As a conceptual framework, resilience has been adopted to evaluate sustainability, transportation security, socio-ecological systems, ecological crises, water resource system, etc. (Chelleri et al., 2015; Cox et al., 2011; Fikret Berkes, 2003; Folke et al., 2010; Wang and Blackmore, 2009).

The fifth largest research cluster comprises climate change literature. The influence of climate change on the resilience, vulnerability and adaptive capacity of rural areas is attracting increased attention. For instance, resilience has established a bridge between conceptual thinking and practical action in climate change research (Morecroft et al., 2012), which could be used to assess the capacity to cope with extreme climate change, such as climate events and typhoons (Testa et al., 2015; Wang et al., 2012b). Based on a case study in an Australian town, Keogh et al. (2011) indicate that residential activities, such as personal responsibility for preparation and personal mitigation activities, contribute significantly in coping with environment change. Other studies use resilience for measuring land use changes (Andreoni and Duriavig, 2013; Rescia et al., 2010). For instance, the relationship between landscape changes and the loss of resilience are investigated based on a case study of two Nature Reserves in Spain (Rescia et al., 2010), while Andreoni and Duriavig (2013) observe low land use diversification to be associated with low resilience in the south-east of Brazil's state of Bahia. In contrast, the results of the co-citation analysis indicate that none of the labels of the 29 co-citation clusters generated by CiteSpace is related to land use policy.

It can be concluded, therefore, that there are insufficient studies on a global scale entailing quantitative research into changes in rural resilience from a land-use policy perspective. The main reasons are firstly, because the focus on rural resilience is relatively recent, no uniform definitions are available, making quantitative research into this topic a challenging task (Anthopoulou et al., 2017). Secondly, some of the approaches measuring the effects of land use policy on rural resilience are difficult to apply (Roberts et al., 2017). Therefore, this study examines the quantitative impacts of land use policy on rural resilience from these two aspects.

2.2. Land use polices in China

Land use policies are undoubtedly a critical factor affecting rural development (Li et al., 2015). Changes in China's land use policy not only affect rural development, but also determine the advancement and declination of rural areas. For example, the household responsibility system, a family-based contract system that was implemented in rural areas of China in the early 1980s, entailed initial adjustments made in areas of related interest that actively increased the efficiency of resource allocation. The growth of China's agriculture and of its entire economy, which was triggered by this change, has actively encouraged the development of various aspects of the reform of the country's political and economic systems. Thus, the adoption of rational land use policies not only promotes economic development in rural areas, but also stimulates the development of the entire nation. In recent years, with the continual advancement of urbanization and rapid development of the Chinese economy, there has been a large influx of farmers into the cities. Land use efficiency has decreased because of the large area of vacant land left in rural homesteads (Feng et al., 2014; Wang et al., 2012a). Moreover, the legal provision disallowing rural homesteads from entering the market has further hindered the overall planning process for developing urban and rural areas.

The issue of land required for rural housing has become an increasing concern for central and local governments, resulting in the launch of the WMRH policy. Withdrawal mechanism for rural homesteads (WMRH) refers to a type of rural construction land circulation that farmers completely abandon land use rights for better welfare compensation. The establishment of such mechanism, which based on the incentive and restraint rules, is an important way to improve the management system of rural residential land. At present, different regions have different practices and explorations in the withdrawal of rural homesteads. According to the organizational structure, WMRH can be divided into four categories: government dominated mode, villager spontaneous mode, enterprise promotion mode, and the market allocation mode. This policy is representative of rural land-use

reform policies that have significantly influenced rural resilience (Ouyang et al., 2009). Through a comparative analysis of changes in the conditions of rural resilience before and after introduction of the WMRH policy, this study contributes to enriching the literature on rural resilience by providing new insights into land use policy.

3. Assessing rural resilience

There have been two comprehensive revisions of the resilience concept following its initial proposal, resulting in a shift from a focus on engineering and ecological resilience to evolutionary resilience, which places greater emphasis on social and economic conditions (Holling, 1973). The accomplishment of each successive revision has been indicative of an incremental advance in the cognition and understanding of the concept. On the whole, the conceptualization of resilience has advanced from being one-dimensional initially to entailing four dimensions of engineering, ecology, economy and society (Holling and Gunderson, 2016). Thus, in this study, rural resilience is the passive process of monitoring, facilitating, maintaining and recovering a virtual cycle between ecosystem services and human wellbeing through concerted effort under external influencing factors including four dimensions of engineering, ecology, economy and society.

We therefore designed an assessment index system for rural resilience (see Table 1) based on China's evolutionary features and rural conditions. Specifically, the system includes the four first-class indices of engineering, ecological, economic and social resilience. *Engineering resilience* emphasizes the overall level of hardware facilities as the key function (Wang and Blackmore, 2009) when contending with disaster. It includes four second-class indices of the acreage of road areas, drainage tube density, road network density and Internet penetration rate. *Ecological resilience* mainly focuses on the capacity to restore the original ecological balance, or to achieve a new balance in rural areas after the intervention of various factors (Fikret Berkes, 2003). It includes the four second-class indices of the average area of public green space, safe treatment rate of municipal solid waste, forest coverage rate and the standard industrial wastewater discharge rate. *Economic resilience* reflects economic power as well as the optimization of the industrial structure and sustainable economic development (Walker et al., 2004). It includes the proportion of agricultural incomes to total incomes, non-farm incomes, average GDP and land GDP. *Social resilience* emphasizes people's ability to act positively to resist the impact of external changes when facing an actual situation (Khalili et al., 2015). It includes four second-class indices of the Engel coefficient, population density, health insurance coverage and the number of people with access to doctors.

We apply the Delphi method (Radeljak Kaufmann, 2016) to calculate the index weight. This method aims to achieve consensual validity by providing questionnaires with controlled feedback to allow interaction within a panel of raters (Passig, 1997). The method has been widely used in natural resources and environmental management studies, for instance in articulating improvement strategies for environment management (Gokhale, 2001) and rating indicators to assess urban sustainability (Musa et al., 2015). Experts from government departments and academia (four government administrators, three professors from research institutions and three associate professors), with an in-depth understanding of rural land policies at the national and local levels, were invited to score the index weights, which were then rank ordered, excluding the lowest and highest scores. The results were resubmitted to the experts for re-rating. Three rounds of expert consultations were conducted, with a rechecking rate of 100%, to determine the ultimate weight of each factor. The following equations are used to obtain the positive and negative function indices respectively in the non-dimensional treatment of raw data

$$a_I = (x_i/y_i) \times 100\% \quad (1)$$

$$a_i = (y_i/x_i) \times 100\% \quad (2)$$

where x_i is the measured value of the index and y_i is the target value of the index. In this study, the target index of agricultural income, non-farm income, the Engel coefficient, endowment and medical insurance, and employment opportunities are obtained based on investigation and survey, with the highest values recorded in the surveys selected as the target values. There are three regions, which have different economic and social characteristics. If the target values are chosen in line with each regional development situation, there would be three highest value for each index − which is both unreasonable and infeasible. The highest value of each region is therefore chosen as the target value in order to compare their survey data. A target index of 100% is required for measuring the medical insurance coverage rate, internet coverage rate, safe domestic waste treatment rate and industrial wastewater discharge standard rate. For other target values, the highest value of studies of the same type of rural areas is set as the target index.

4. Changes in rural resilience resulting from the WMRH policy

4.1. Study areas

The WMRH entails a type of land transference aimed at improving land use efficiency through the withdrawal of peasants and assignment of their land to a collective organization based on the applicable laws and regulations. Tianhe, Shizhu and Huishan Counties in the cities of Guangzhou, Chongqing and Wuxi are all national pilot units for testing the withdrawal mechanism for rural homesteads. These three areas are

Table 1
Rural resilience assessment index system.

First Class Index	Weight	Second Class Index	Weight	Target Value	Units
Engineering Resilience (A)	0.21	Road area per capita (A1)	0.33	10	m2/people
		Drainage tube density (A2)	0.23	20	km/km^2
		Road network density (A3)	0.29	13	Km/km^2
		Internet penetration rate (A4)	0.15	100	%
Ecological Resilience (B)	0.22	Public green land area per capita (B1)	0.28	10	m2/people
		Municipal solid waste harmless treatment rate (B2)	0.23	100	%
		Forest coverage rate (B3)	0.18	60	%
		Industrial waste water discharge standard rate (B4)	0.31	100	%
Economic Resilience (C)	0.3	Agricultural income proportion in total income (C1)	0.2	20%	%
		Non-farm income (C2)	0.25	50000	yuan/year
		GDP per capita (C3)	0.3	100000	yuan/year
		GDP per land area (C4)	0.25	5000	Million yuan/km^2
Social Resilience (D)	0.27	Engel coefficient (D1)	0.3	15	%
		Population density (D2)	0.25	1800	people/km^2
		Health insurance coverage rate (D3)	0.22	100	%
		The number of people with doctors (D4)	0.23	50	people/million people

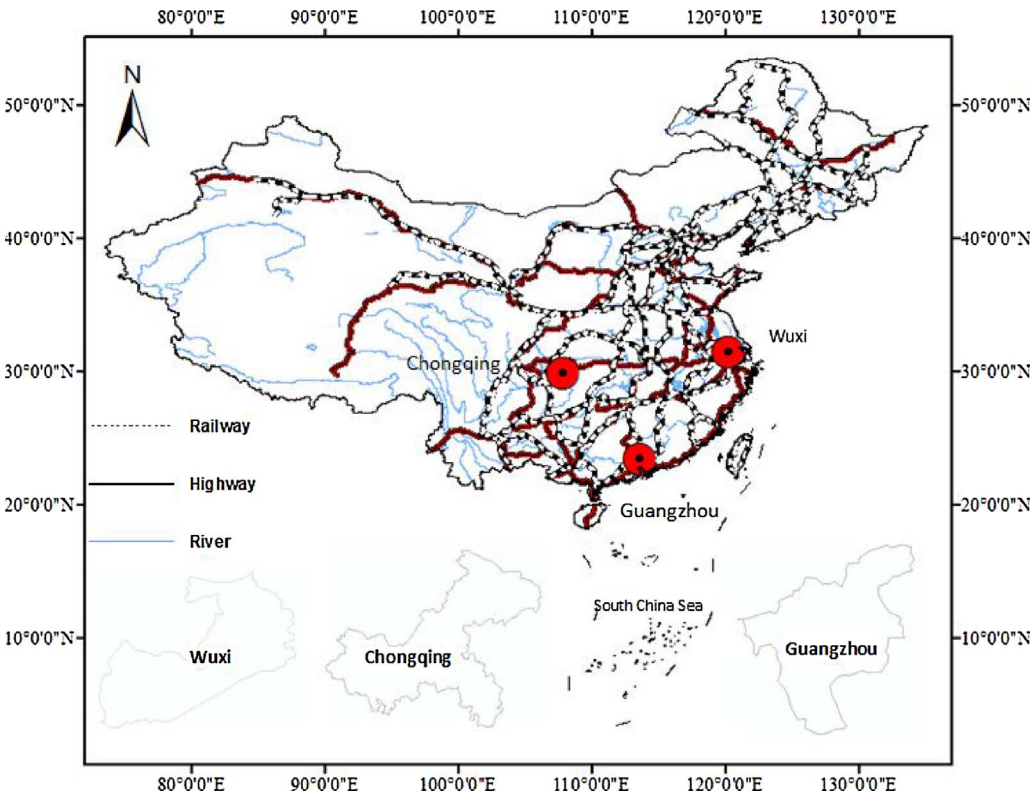

Fig. 3. Study areas.

therefore selected as the study areas (Fig. 3). In 2009, Huishan District in Wuxi became a "double substitution" pilot area, where farmers' rural housing was replaced by housing in cities and towns, and farmland was replaced by social security according to the local WMRH. Shizhu County in Chongqing formally implemented its "land coupon" policy in 2012, indicating that the rural land construction quota functioned as a land coupon for trading through the exchange of rural for urban space in the market. It usually leads to a higher land value and lower cost of land deals (Yep and Forrest, 2016). Under the government's guidance, Tianhe District in Guangzhou has officially launched a withdrawal mechanism for rural homesteads entailing a village collective as an agency providing forms of social financing.

The economic development patterns of Guangzhou, Wuxi and Chongqing have clear geographical references, representing the economic development models of southern, eastern and western China respectively. Guangzhou's export-orientated market economy is typical of regions in southern China. Orientated to the needs of the international market and the expansion of exports, Guangzhou plays an active role in the international division of labor and competition to encourage economic development and growth (Hu and Lin, 2011). Chongqing's inward-oriented policy and model of economic development is typical of mid-western China. With the introduction of the government's strategy of promoting the development of western China, a significant number of economic preferential policies have emphasized the central and western regions (Li, 2015). This region's economic development is primarily contingent on domestic production and market factors. Wuxi is representative of the development model of an open private economy followed in eastern China. Relying on small private enterprises in the region, Wuxi is striving to forge connections between domestic and international economic spheres (Yuan et al., 2014).

Because the WMRH policy was implemented at different times within the different regions, 2008, 2009 and 2011 are selected for assessing the pre-implementation periods in Tianhe, Shizhu and Huishan respectively. The year 2015, following the policy's introduction, is set for all of the regions. Based on the construction of the assessment index system discussed in section 3, a comparative analysis was conducted of the changed conditions in rural resilience in the three regions before and after the introduction of the WMRH policy.

4.2. Results

Rural resilience in the three study areas is evaluated based on the assessment index system that developed for this study. Table 2 shows the results of the evaluation. In the Huishan District of Wuxi, the rural resilience index rose from 0.40 to 0.75, evidencing an increase of 88% after the WMRH policy was implemented. The individual components of engineering, ecological, economic and social resilience increased by 72%, 70%, 227% and 45% respectively. A comparison of the three study areas shows the influence of the land circulation policy to be most marked in this region, with the economic index rising from 0.22 to 0.73; an increase of 227%. Significant increases in the proportion of agriculture incomes and average GDP index (491% and 311%, respectively) are attributable to the WMRH policy. Following the introduction of the WMRH policy in Shizhu County of Chongqing, the rural resilience index rose by 61% from 0.34 to 0.54, with engineering, ecological, economic and social resilience showing increases of 63%, 73%, 121% and 25% respectively. The comparative analysis indicates that Chongqing's land circulation policy had the most marked influence on ecological resilience, with a rise in the ecological resilience index from 0.39 to 0.67. Because of the WMRH policy, indicators of the standard rate of industrial wastewater discharge shon a significant increase of 274%. After the WMRH policy was implemented, Chongqing farmers still retained contracted land management rights subsequent to reclamation and obtained benefits from land transfers, resulting in a rise in the proportion of their agriculture incomes to 15%. Following the introduction of the WMRH policy in Tianhe District of Guangzhou, the rural resilience index rose by 123% from 0.37 to 0.82, with engineering, ecological, economic and social resilience increasing by 124%, 61%, 220% and 114% respectively. A comparison of the three study areas shows that the land circulation policy in Thanhe District had the most marked influence on engineering and social resilience, with the engineering and social resilience indices rising to 0.77 (a 124% increase) and 0.89 (a

Table 2
Changes in rural resilience resulting from the WMRH policy.

Index	Tianhe, Guangzhou			Shizhu, Chongqing			Huishan, Wuxi		
	before	after	%	before	after	%	before	after	%
A	**0.35**	**0.77**	**124%**	**0.49**	**0.81**	**63%**	**0.49**	**0.84**	**72%**
A1	0.33	0.86	161%	0.40	0.80	100%	0.48	0.86	81%
A2	0.28	0.76	174%	0.65	0.85	31%	0.37	0.73	97%
A3	0.31	0.72	133%	0.54	0.87	61%	0.60	0.88	47%
A4	0.56	0.71	27%	0.37	0.63	70%	0.47	0.87	84%
B	**0.47**	**0.76**	**61%**	**0.39**	**0.67**	**73%**	**0.45**	**0.76**	**70%**
B1	0.76	0.79	4%	0.57	0.64	13%	0.46	0.92	99%
B2	0.32	0.89	178%	0.34	0.65	91%	0.53	0.66	25%
B3	0.46	0.47	2%	0.48	0.53	12%	0.58	0.77	33%
B4	0.34	0.81	141%	0.21	0.79	274%	0.31	0.70	128%
C	**0.26**	**0.83**	**220%**	**0.14**	**0.31**	**121%**	**0.22**	**0.73**	**227%**
C1	0.37	0.73	100%	0.13	0.15	15%	0.11	0.65	491%
C2	0.22	0.71	218%	0.15	0.19	25%	0.28	0.78	181%
C3	0.19	0.94	408%	0.09	0.10	13%	0.19	0.76	311%
C4	0.30	0.89	199%	0.19	0.81	318%	0.30	0.70	132%
D	**0.42**	**0.89**	**114%**	**0.40**	**0.50**	**25%**	**0.49**	**0.71**	**45%**
D1	0.25	0.93	268%	0.21	0.32	50%	0.54	0.63	17%
D2	0.50	0.91	83%	0.50	0.57	13%	0.50	0.74	48%
D3	0.50	0.83	66%	0.50	0.58	15%	0.50	0.70	39%
D4	0.46	0.88	90%	0.43	0.57	33%	0.42	0.81	94%
Rural resilience	**0.37**	**0.82**	**123%**	**0.34**	**0.54**	**61%**	**0.40**	**0.75**	**88%**

114% increase) respectively.

Overall, the rural resilience indexes increased in all three regions, with maximum increases evident in Tianhe District in Guangzhou after the policy's introduction. This indicates that the region of rural homestead transfer mode provides a useful reference. Based on the assessment index, the WMRH policy had a significant influence on changes in rural resilience. Increases in the economic resilience of Guangzhou, Chongqing and Wuxi (220%, 121% and 227% respectively) far exceeded those of the three other categories of indicators. In sum, the WMRH policy had a positive effect on rural resilience, with different influences resulting from variations in the withdrawal mechanisms applied to rural homesteads.

5. Discussion

5.1. Characteristics of the WMRK in the different study areas

5.1.1. Operational mode

The homestead withdrawal mechanism in Guangdong Province is relatively flexible and the main sources of its funds include land auctions, bank credit, self-financing of the village collective and a real estate trust. The homestead reclamation pattern for the land coupon in Chongqing entails the balancing of urban and rural development in western regions through an innovation relating to the land circulation system in the pilot initiative (Wang et al., 2016a). This pattern entails the government's domination of the land reclamation process, and retention and packaging of the rural land construction quota as a land coupon to be traded through rural land exchange after reclamation. The compensation price for farmers, which is based on the market mechanism, floats on the government-regulated price. The double substitution pattern in Wuxi refers to the replacement of farmers' rural housing by that provided in cities and towns, and of their land contracted management rights with social security. Consequently, farmers' identities are being transformed into those of urban residents. The original scattered form of natural villages will thus gradually shift into a cluster form similar to that found in urban areas. Moreover, with the transformation of farmers' identities, the mode of rural management is being gradually blended and integrated with the management mode (Xu et al., 2014).

5.1.2. Marketization

Many behavioral agents have participated in the homestead exit process in Guangdong, and the operation of social capital has become widespread. Our comparative analysis reveals that the government played a decision-making and regulatory role during the homestead exit process in Guangdong. In Chongqing's land coupon system, the government played a dominant role in the approval of farmers' applications and in the subsequent exploration and reclamation processes. The market mechanism existed solely in relation to the final "indicator trade." The double substitution policy implemented in Wuxi city entailed the demolition of homesteads, the construction of resettlement residential areas and the provision of compensation (Chen et al., 2017). However, a market mechanism was lacking, as all of these processes were dominated by the local government.

5.1.3. Prospective earnings

Double substitution in Wuxi, as well as transforming homesteads into housing through a government-initiated public program in Guangzhou, have both led to improvements in farmers' living conditions. However, there has been a 2-or-3-year cycle of "negative earnings" relating to prospective earnings. In Guangzhou, prospective earnings from land circulation and homestead leasing, prompted by the village collective, mainly depend on rents, salaries and stock dividends, all of which depend on the degree of development of the local land market and the overall level of economic development (Li and Liu, 2017). Farmers in Chongqing obtained a single payment after the implementation of the land coupon system. Moreover, after reclamation, arable land continues to generate new revenue for farmers. However, circulation behavior has not directly led to changes in welfare conditions, such as competition for jobs and social security.

5.1.4. Compensation references

In addition to being provided with replacement housing, farmers have also received share dividends in Guangzhou, with share allocations determined by the farmers' ages. Chongqing's land coupon policy entails compensation based on a homestead's covered area, with all farmers sharing a common standard (Wen et al., 2017). Changes in benefits obtained during exchange transactions are solely determined by final auction prices. In Wuxi, housing compensation is based on a homestead's floor area, while social security compensation is determined by a farmer's age. Consequently, there are differences in

Table 3
Changes in rural resilience resulting from the WMRH policies.

Objects	Pattern of economic development	Increased scope for rural resilience
Tianhe, Guangzhou	Export-orientated market economy	123%
Shizhu, Chongqing	Domestically-orientated policy economy	61%
Huishan, Wuxi	Open-orientated private economy	88%

welfare distribution between farmers.

5.2. How the WMRH has affected different aspects of rural resilience

Our assessment indicates that the introduction of WMRH policies improved local rural resilience by 123%, 61% and 88% in Guangzhou, Chongqing and Wuxi respectively (Table 3). Different aspects of rural resilience, including engineering resilience, ecological resilience, economic resilience and social resilience, increased through the provision of land quotas for rural infrastructure construction and economic development – gathering scattered rural settlements and strengthening the social security systems in rural areas.

5.2.1. Engineering resilience

Rural engineering resilience in Guangzhou, Chongqing and Wuxi has increased by 124%, 63% and 72% respectively. The rural homestead exit policy has enabled the development of local engineering infrastructure and improved the flexibility of rural engineering (Zhong et al., 2014). The previous system of free and indefinite use of rural homesteads not only resulted in a waste of land resources, but also hindered the implementation of rural construction planning and the construction of rural infrastructure. On the one hand, the homestead circulation policy has enabled infrastructure planning to take place. On the other hand, the redundant quota after land reclamation has become an important source of rural infrastructure construction land quota (Wen et al., 2017).

5.2.2. Ecological resilience

Rural ecological resilience in Guangzhou, Chongqing and Wuxi has increased by 61%, 73% and 70% respectively. The rural homestead exit policy has had a positive impact on environmental protection and the promotion of an ecological civilization in rural areas. Prior to the adoption of the policy, the layout of rural settlements in the study areas was discrete and disordered, leading to difficulties in configuring public green spaces, which were, therefore, absent in rural areas. There was no integrated drainage system, resulting in the widespread phenomenon of sewage discharge (Xu et al., 2015). Garbage collection facilities were not rationally distributed. Consequently, many farmers disposed of garbage in an unplanned manner, causing significant environmental damage. With the introduction of the rural homestead exit policy, a considerable proportion of farmers were clustered together. This has had a positive impact on the development of public green areas and safe treatment of household garbage. The central placement of farmers has also contributed to effective management of rural enterprises and a rise in the allowable rate of industrial wastewater discharge.

5.2.3. Economic resilience

Rural economic resilience in Guangzhou, Chongqing and Wuxi has increased by 220%, 121% and 227% respectively. Local land stocks have been revitalized as a result of the rural homestead exit policy, which has consequently contributed significantly to local economic development and enhancing the non-agricultural incomes of residents (Zhong et al., 2012). It has therefore improved the economic resilience of rural areas. Over a long period of time, rural areas and agriculture developed at a slow pace, making it difficult for farmers to increase their income. Moreover, insufficient primitive accumulation and funds further restricted the pace of development. In turn, capital accumulation was constrained by the slow progress of development, leading to a vicious cycle hindering the progress of rural development. The rural homestead exit policy has effectively resolved the problem of the shortage of funds required for rural construction. A greater freedom to trade land ownership has enabled collective construction land to be more efficiently utilized. This will have a considerable positive effect in alleviating tensions over suburban land supplies and will significantly increase the value of collective construction land. Moreover, it will provide support for local economic development and increase the incomes of rural residents.

5.2.4. Social resilience

Rural social resilience in Guangzhou, Chongqing and Wuxi has increased by 114%, 25% and 45% respectively. The rural homestead exit policy has not only been achieved without any additional burdens on local farmers, but it has also effectively enabled improvements in local social security systems as well as enhanced social resilience in rural areas. Government-regulated homestead exit planning is helping to ensure the equitable exchange values of homestead use rights (Chen et al., 2015). The conversion of contracted land management rights into social security that can be accessed in towns and cities enables the farmers to enjoy urban social security and has improved the medical insurance coverage rate.

6. Conclusion

Rural resilience can be defined as the capacity of a rural area to cope with changing external circumstances (Heijman et al., 2007) and is used for rural development theorizing. In China, rural resilience is highly associated with land use policies. In recent years, with the country's rapid urbanization, many land use polices have been devised to deal with the changing circumstances involved. This has attracted the growing attention of researchers and policy makers. Nevertheless, there has been a lack of research into the impact of land use policies on rural resilience. In response, this paper links land use policies with rural resilience, specifically focusing on the effect of the WMRH policy in three areas in China (Guangzhou, Chongqing and Wuxi).

Our assessment indicates that the introduction of WMRH policies improved local rural resilience by 123%, 61% and 88% in Guangzhou, Chongqing and Wuxi respectively. It is noteworthy that the WMRH policy is closely related to local economic development and government finance (Tang et al., 2016). On the one hand, based on the market mechanism and government controls, farmers can be compensated more in affluent regions in general, which increases local social resilience accordingly. While, in less-developed regions, villagers might be worse off after land expropriation (Sargeson, 2013). On the other hand, land is often sorely needed in more-developed areas, where conflicts between the development and demand for construction land are intense. Land quotas may significantly trigger the local economy and construction work, improving economic resilience and engineering resilience. Additionally, despite rural social resilience being partly measured by the level of compensation (e.g., their plans of transferring rural land and settling down), farmers' intentions may be overlooked with the WMRH policy (Tang et al., 2016) and rural social resilience may differ due to the different individual and household characteristics of farmers, such as age, employment, income and expectations (Zhang et al., 2016).

The findings of this study also indicate that an export-orientated economic pattern, strong land market and diligent governmental management may lead to an obvious increase in rural resilience, with the introduction of the homestead exit policy. In the three study areas, the outcomes of the homestead exit policy have differed depending of their varying economic, market and governmental characteristics

Table 4
Changes in rural resilience resulting from the WMRH policies.

Objects	Location	Pattern of economic development	Degree of development of the land market	Degree of government regulation	Increased scope for rural resilience
Tianhe Guangzhou	Southern China	Export-orientated market economy	Strong market	Strong government	123%
Shizhu Chongqing	Western China	Domestically-orientated policy economy	Strong market	Weak government	61%
Huishan Wuxi	Eastern China	Open-orientated private economy	Weak market	Strong government	88%

(Table 4).

The relationship between the government and the market also directly affects changes in rural resilience resulting from the policy's adoption. On the one hand, the degree of development of the land market determines the allocation efficiency of land resources, with rural resilience largely being a response to the efficiency of resource allocation, with active rural land markets enabling scale economies (Wang et al., 2016b) and agricultural outputs (Kleinwechter and Grethe, 2012), increasing rural resilience accordingly. On the other hand, the scientific formulation of a homestead exit policy, based on village and township planning, is a prerequisite for improving rural resilience. The government's monitoring and management of the land market will ultimately determine the efficiency and effectiveness of the circulation of land ownership, while the government's strong intervention will decrease the resilience of the land market (Yan et al., 2014). Thus, improving rural resilience involves more than just paying attention to the effects of the market on the optimal allocation of resources, but also appropriate government regulations. How to reach a balance between government control and market freedom to heighten rural resilience is an important topic worthy of more research in future.

Acknowledgement

Thanks for the research data supplied by Mr Ben Ma' data, and the valuable suggestions provide by Dr. Tang Shuangshuang and Dr.Qixin Xian at Nanjing University; The research reported is supported by the National Natural Science Fundation of China (71673232), CityU internal Funds for PRC grant (9680195), CityU strategic Research Fund for unfunded GRF (7004950), CityU research project for-Infrastructure support from the Central (9610386); The work described was also supported by the Research Grant Council of Hong Kong (Project No: CityU11271716 and CityU21209715).

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