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Can China's land coupon program activate rural assets? An empirical investigation of program characteristics and results of Chongqing

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ABSTRACT

Harmonizing land use across space to optimize residential and agricultural land uses is an issue in many developed and developing countries. China, where the state has strong property rights, has developed its own set of policies to address this problem. One of the most common policies is the land coupon, a scheme where rural residential lands are reclaimed to farmland, and equivalent amounts of farmland located in urban regions are converted to construction (residential, industrial, or commercial) land. The scheme aims to preserve the total amount of farmland within a region, while also allowing cities to add commercial and residential buildings on former farmland. The purpose of this paper is to introduce an English speaking audience to the land coupon program in Chongqing, describe its characteristics, and finally investigate in depth the efficacy of the program to activate rural assets. Choosing Chongqing as our study area, we use a price gradient model to estimate the gap between prices compensated to rural residents for their residential land and the price of the land coupons at auction. We also compare the compensation to urban farmland owners, and rents to urban commercial land. The results indicate that 1) The average price gradient between supply (1.71 thousand yuan/m^2) and demand regions (3.14 thousand yuan/m^2) indicates that there is still a large land value gap between regions; 2) the scarcity degree—the amount of excess land in a city region that can be converted to agriculture—is a significant predictor of coupon price in both supply and demand areas; and 3) scarcity degree usually has an impact on price, negatively in supply regions, but in demand regions, there is a U-shaped relationship between price difference and scarcity degree.

1. Introduction

Land, has played an important role in China's economic growth since economic reforms in the late 1970's, with growth of urban built-up land since this time (78.5%) growing faster than the national population (46%) (Bai, Shi, & Liu, 2014). According to the National Bureau of Statistics of China (NBSC), the growth rate of China's Gross Domestic Product (GDP) has sustained more than 10% for 30 straight years. The contribution of land revenue to local economic growth is important, and makes up to 70% of government revenue in various regions of China (Zhu & Shi, 2010). China's high economic growth relies on rapid development, urbanization and industrialization, which drives the conversion of farmland to urban construction (i.e., residential, commercial and industrial) land. Between 1990 and 2010, more than 40 million hectares (ha) of farmland were converted to urban land uses, and since 1984, the built-up land in China has increased by nearly 500% (Liu, Fang, & Li, 2014).

These processes have led to a value gap between rural and urban lands, which is described as a process of “accumulation through dispossession” by Harvey (2003). Because article 10 of the Constitution of the People's Republic of China explicitly states that all urban land is owned by the state (guoyou) and all rural land is owned by the peasants and collective (jiti), China's land market is divided for rural and urban lands (Chen, Wang, & Huang, 2015). The Chinese land market operates within distinct jurisdictional settings, meaning that urban land markets operate under different sets of property laws than rural markets. Furthermore, the Land Management Law (1988) allowed landowners to lease land-use rights in exchange for capital, but did not permit rural lands to

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enter the market and transfer the land-use right to developers directly. When rural lands are acquired by the government for urban uses, a so called "scissor gap" exists(Carter, 1986), because the compensation given to rural residents who are using the land that will be converted, is often dramatically lower than the revenue that is generated by the state upon development of the land. This market dynamic has allowed local governments to accrue roughly 200 billion Yuan (about 31.26 billion USD) from rural land acquisitions since 1978 (Chen, 2004), while farmland owners received only 5–10% of this value (Chen, Chao, Cai, Xing, & Chen, 2014).

The fast urbanization and conversion of agricultural land uses results in an inefficient use of rural construction lands and strict arable land protection systems. Nonagricultural employment opportunities created by urbanization have lured rural jobless farmers to urban areas. Some farmers become what are known as rural-urban "double residing immigrants" (Xu and Xie, 2015), which is a social phenomenon commonly observed in some developing economies, for example Sub-Saharan Africa (Brauw, Mueller, & Lee, 2014). These people still own their agricultural plots and rural residential land but work and live in urban areas. According to China's official statistics, 16.9% of Chinese are double residing immigrants at present. This massive migration to urban areas has given rise to idle agricultural and rural residential land, making rural communities "hollowed villages" (Long, Zou, & Liu, 2009; Liu, Liu, Chen, & Long, 2010). The phenomenon is unique to rural settlement shaped by the "dual-track" structure of rural-urban development (Long, Liu, Li, & Chen, 2010; Wu, 1997), and closely resembles the "dying villages" in parts of rural Eastern Europe (Reichert-Schick, 2010). There are 17 million ha of idle rural construction lands—approximately 15% of the total rural construction lands in China. The per capita residential land in rural China is 229 m^2 (Han, 2011), relatively large compared to that in urban centers (14.67%). The central government has resisted creating a rural land market because of fears about food security and farmer stratification, which has led to barriers that prevent rural farmers from selling excess residential land.

The growing demand for arable land near cities, however, has increased the risk of resource loss and degradation. Aiming to protect arable land and the surrounding environment, the arable land protection system—Requisition-compensation Balance of Arable Land—was implemented under the Land Management Law (1998), which mandates that units that occupy arable land for urban uses must reclaim the same quantity of arable land (Liu et al., 2014). China's Land Annual Quotas Distribution System was additionally established in 1999 to support this arable land protection system. According to the Measures for the Administration of Annual Plans on the Utilization of Land (1999), annual land quotas regarding supplementary arable land and construction occupation on arable land, are made and distributed from the state to the lower level governments (Li, Li, Hans, & Liu, 2015). Therefore, each level of government, except for county governments, are required to balance the loss and gain of arable lands (Ou, Nong, & Chen, 2014). Under this system, it is challenging for local governments to develop the local economy if the available quantity of available arable lands is not sufficient enough to provide the required balance.

2. The Chongqing land coupon program

2.1. The origins of the land coupon

In order to address the above challenges, various institutions have been created to explore legal mechanisms to transfer collective construction lands; examples include the Land Shareholding System in Nanhai, Guangdong Province (Jiang & Liu, 2003; Liu, 2008; Wang, 2003), the Homestead-for-Apartment Exchange System in Binhai, Tianjin (Cui, 2010; Yang, 2013), and the Transfer of Farmland Development Rights program in Zhejiang Province (Chau & Zhang, 2011; Wang, Tao, & Tong, 2009). The central government has also created a series of institutions[1]. With the regulation passed by the State Council in 2004, the Ministry of Land and Resources in China (MLRC) proposed an innovative land management policy known as the "*Increasing vs. Decreasing Balance*" land-use policy (Zengjian Guagou)[2] to relieve the shortage of urban land supply and to make better use of vacant built land within villages (Liu et al., 2014). These reforms catalyzed the establishment of the land coupon program.

The land coupon program is a scheme that allows for the conversion of urban agricultural land to construction land if an equal amount of rural construction land is reclaimed to farmland. This is quite similar to "Increasing vs. Decreasing Balance" (Long, Li, Liu, Woods, & Zou, 2012) as they both require land reclamation and maintain a constant amount of farmland (Liu et al., 2014), however, the policies differ dramatically in terms of operation and revenue distribution. Both policies enable the municipal administration to initiate development and construction in other locations within its jurisdiction where the value of land is higher (Yep & Forrest, 2016). In many ways the land coupon is similar to the Transfer of Development Rights (TDR) (Richards, 1972; Johnston and Mary, 1997). Similar policy instruments derived from TDRs have been developed in other countries, such as the Green Space Structure Plan (Louw, Krabben, & Priemus, 2003) and re-allotment process (Leenen, 2014) in the Netherlands, the Land Exchange in Japan (Ito, Mari, Mami, & Hart, 2016), the Auctioned Tradable Development Rights (ATDR) policy in the Czech Republic (Vejchodská, 2016), the Tradable Planning Permits (TPP) policy in the European Union (Henger & Bizer, 2010), and TDRs in Taiwan (Shih & Chang, 2016).

Land coupons have the potential to influence property rights distribution, population flows, and economic development (Brauw and Mueller, 2012). The actual impacts of the land coupon, however, are not well understood. Some argue that the land coupon functions similarly as TDRs because rural land in urban areas can not be developed unless a land coupon with the same amount of rural land has been sold (Kaplowitz, Machemer, Pruetz, 2008). Land coupon programs can also transform fixed land capital into floating capital to meet the demand of urban development, while increasing the value of rural lands (Qin, Deng, Qiu, 2013), and helping to harmonize urban and rural regional development (Zhou and Lu, 2011). In contrast, some studies claim that land coupon programs do not include the regulatory mechanisms necessary for ensuring that the quality of reclaimed arable land will be equal to that of the developed land (Huang and Zhu, 2013), therefore doing little to protect against food insecurity. In addition, the land coupon may cause land rent-seeking behaviors because of the ambiguous scope of the administrative authority during the process of land coupon exchanges (Li, 2013; Yuan, 2013).

There are pilot programs in 29 provinces in China (Wang, Fang, & Wang, 2011) running the *Increasing vs. Decreasing Balance of Urban-Rural Built Land* program, but only a few utilize a land coupon component. The majority of experimental land coupon

[1] The regulation of deepening reform on the strict land management passed by State Council in 2004, the decision to promote rural development to realize the same rights and price with the same urban and rural land issued by 17th CPC Congress in 2008, and building a unified rural-urban construction land market to allocate scare land resource and balance revenue distribution among stakeholders decided by the 18th CPC Congress in 2013.

[2] MLRC, Document #207 (2005): to standardize the implementation of linking up increased urban construction land with decreased rural construction land at selected test points.

programs, also referred to as *land bill systems* in some instances (Yep & Forrest, 2016), can be categorized into five different models—the program in Chongqing (Yep & Forrest, 2016), the program in Chengdu (Tang & Tan, 2013), and the Green, Red and Blue coupons programs in Jiangsu, Zhejiang, and Shanghai, which differ slightly in each location (Zhu, 2004). Each of these programs has its own strengths and benefits.

2.2. The operation mechanism of Chongqing land coupon

The Chongqing land coupon transaction consists of three parts; the first is land reclamation (i.e. conversion to farmland) of rural residential lands. The government oversees a process whereby rural collective construction land is registered for voluntary reclamation. Farmers and collectives voluntarily register their land and apply for reclamation. When reclamation has been approved by the government—i.e. the assessment confirms the new farmland meets the regulation issued by the Ministry of Land and Resources(MLR)—the reclaimed land will be returned to farmland. Land coupons, equal in area to the amount of reclaimed land are then developed by the government.

The second phase is the land coupon transaction, where the newly developed land coupons are sold. All market activities take place at the Chongqing Rural Land Exchange(CRLE). Individuals, enterprises and government agencies who have applied for purchasing power can participate in the market, and prices are set by the Land Exchange. When a land coupon is sold, a small percentage(less than 0.1%) of the sale price is held by the Land Exchange to cover the operating costs of the program. 85% of the remaining total goes directly to the farmer who had previously managed the rural construction land, while 15% to the collective.

The final phase of the land coupon transaction occurs when the land coupon is used. When a purchaser buys a land coupon, he or she holds the right to purchase and develop urban farmland equal to the area corresponding to the land coupon. In the absence of the land coupon, one cannot buy and develop farmland even if the farmland is in an area planned for construction. In addition, the value of a land coupon can be deducted from other government taxes that are usually assessed to land exchanges. This monetary incentive for land coupon holders is one of the ways in which the program differs from similar schemes, such as the *land bill* (Yep & Forrest, 2016) and *land ticket* (Wang and Yang, 2009). The three phases of the transaction procedure are presented in Fig. 1.

The land use conversion types associated with the land coupon exchange are described in Fig. 2. It shows that before a land coupon transaction, the parcel of interest in supply regions is a parcel of rural construction land. Within a region of demand there is a piece of arable land of the same size. Once the land coupon has been created, the rural construction land can then be reclaimed to arable land through land rehabilitation, while the arable land in demand regions can be expropriated to urban construction land.

While the land coupon is emerging in China, there have been few studies that explore the efficacy of such programs. Likewise, previous studies have not focused on the value of land coupons for rural farmers or whether they can reduce land value capture from rural areas. We test for this here by measuring the difference between land coupon prices and urban construction rent. We also examine the gaps in urban rent and compensation to urban farmers, to highlight how much of the increase in land rent is captured by urban farmers. Finally, we estimate what attributes lead to disparity in these calculated values.

3. Empirical analysis of land coupon transactions in Chongqing, China

3.1. Study area

We choose Chongqing as our study area as it is the oldest and largest land coupon program in China. Chongqing is the largest city in China, with a total area of approximately 82 400 km^2. It is located in southwest China and encompasses the upper Yangtze River area (Fig. 3). As a municipality directly administrated by the central government, Chongqing is the economic, financial, cultural and technological center of Upper Reaches of Yangtze River. There are 38 districts within the city, and the combined urban built-up area is approximately 650 km^2. The population in 2015 was 33.17 million, of which 30.17 million were permanent residents and 60.94% of the permanent people lived in urban areas. Chongqing municipality is composed of five development priority zones—the Core Metropolitan Function Area (CMFA), the Extended Metropolitan Function Area (EMFA), the Newly Developed Urban Area (NDUA), the Northeastern Ecological Conservation Area (NECA) and the Southeastern Environment Protection Area (SEPA).

3.2. Data collection

All data used for this analysis were retrieved from the Chongqing Rural Land Exchange(CRLE), the Chongqing Municipal Land Resources and Housing Administrative Bureau, and the Chongqing Statistics Bureau (2015). Interviews were conducted with land coupon officials in April of 2015. At that time, there had been 38 land coupon market days and the market prices had fluctuated from a low of 120 yuan/m^2 to a high of 480 yuan/m^2 since 2008. Land coupons sold since 2008 totaled 102 km^2 and the total farmland converted in urban area with land coupons amounted 67.8 km^2. More than 30 969 million yuan was paid for the land coupons. In 2008, the average price per unit of land coupon was about 120 yuan/m^2, rising to almost 370 yuan/m^2 in 2010, and falling to 280 yuan/m^2 in 2015 (Table 1).

Nearly 66% of land coupons have been used in the span of 8 years (Table 2). Overall, the area for all land coupons sold per year increased from 2008 to 2015. The average size for coupons sold and coupons used increased from 2008 to 2011, peaking at 35.27 km^2 and 19 km^2 respectively. Sales and use remained fairly stable in 2013 and 2014 after a decrease in 2012. The fact that some coupons remain unused, means that some coupons purchased during our study period can still be used for development in the future.

Interestingly, most of the land coupon comes from Northeastern Ecological Conservation Area (NECA) and Southeastern Environment Protection Area (SEPA), and were used in the Core Metropolitan Function Area (CMFA), Extended Metropolitan Function Area (EMFA) and Newly Developed Urban Area (NDUA) (Table 2). The total land coupon area in NECA was 47.53 km^2 (46.6% of all coupon area), followed by NDUA and SEPA with 26.39% and 24.92% respectively. Land coupons produced in CMFA and EMFA were minimal, accounting for only 2.29%. Conversely, CMFA and EMFA used two-thirds of all land coupon area, while less than 17% were used in NDUA. The smallest land coupon areas were seen in NECA and SEPA, making up 0.69% and 2.15% of the total area, respectively.

Because the land coupon is an aggregation of multiple reclamation projects, it is difficult to translate the purchasing cost of a land coupon to the value of a particular parcel in the supply regions. To calculate the average land coupon price in each county, we combined each reclamation project and land coupon sold dating back to 2014–1206 projects in total. For each project, we calculated statistics for the area, price and benefits of landless peasants correspondingly, providing us with a cross section of data at the

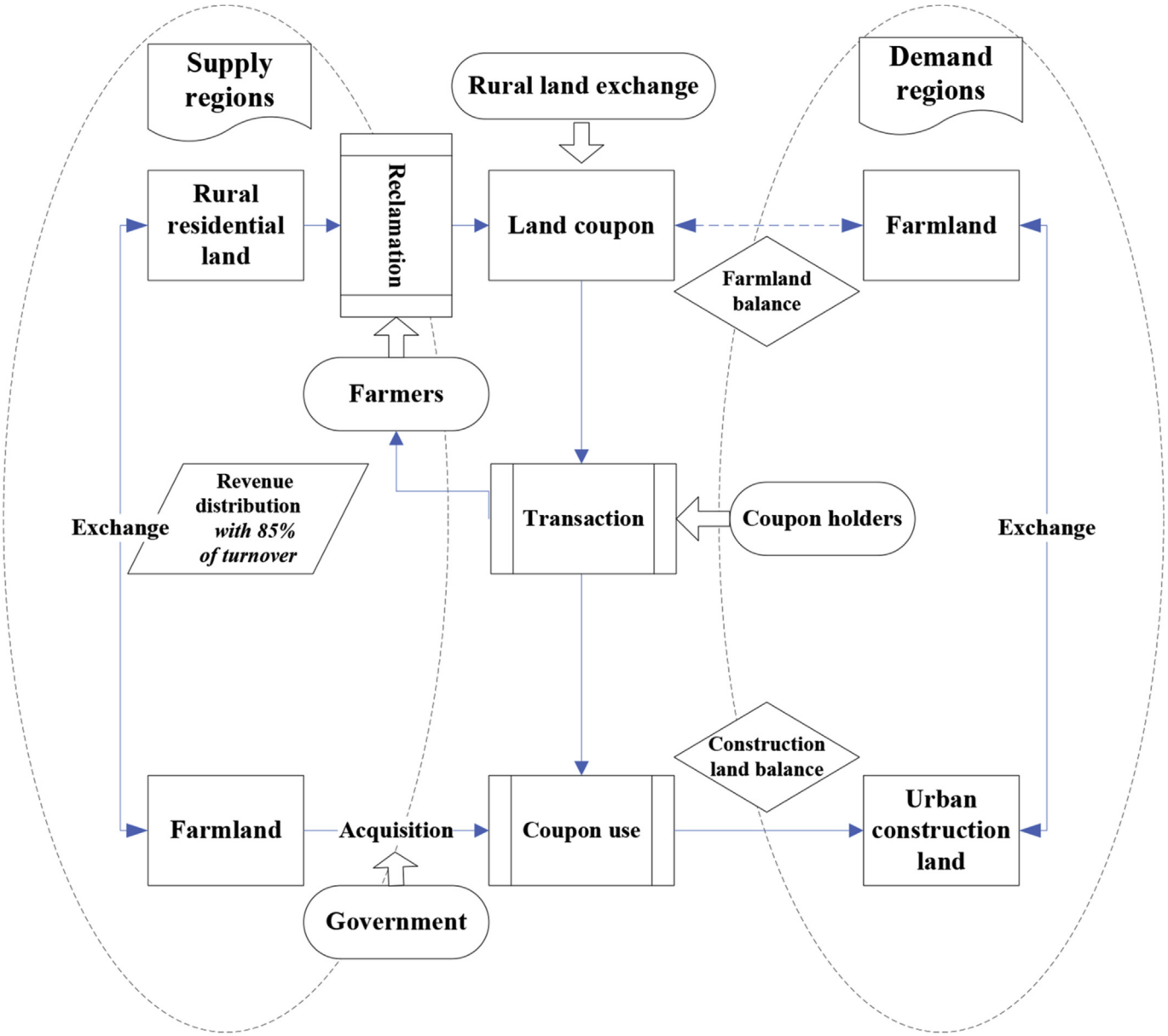

Fig. 1. The three phases of the land coupon transaction procedure in Chongqing.

county level.

3.3. Price gradient model

3.3.1. Differences between prices and ratio of prices

We calculated two price gradient models under the hypothesis that Chongqing is a monocentric city where lands within the same land use type, located adjacently, should be valued equally. Our first goal was to calculate the difference between the land coupon price and the price paid for rent in developed, urban spaces. In a competitive market, or if the coupon program is working as intended, the difference between these prices should be quite small, assuming that the characteristics of the parcels are similar. We calculated the price gradient as:

$$\nabla P_{si} = R_i - P_i \quad (1)$$

where R_i is the rent for parcel i and P_i is the land coupon price.

This represents the price gradient in supply areas and can be thought of as the difference between returns to construction and the price of the land coupon. If there is a low price gradient, it indicated that the land coupon is a large part of the total construction land price. If the gradient is high, it means that the coupon represents only a small fraction of the total construction costs in urban areas.

The second price gradient is between the acquisition price (C) of arable land and construction land rent (R). Because the urban farmland and construction land are on the same parcel, the difference between the two values represents the gain in property value due to the land use transition, which is not acquired by the farmer. Without land improvement by the government, we calculate this value as:

$$\nabla P_{dj} = R_j - C_j \quad (2)$$

where R_j is the rent for parcel j and C_j is the acquisition price.

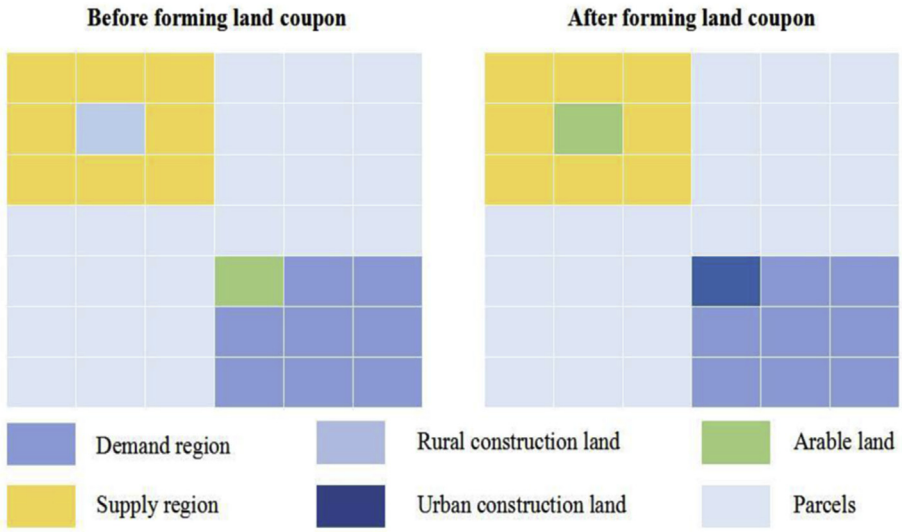

Fig. 2. Typical land use conversion before (left) and after (right) a land coupon transaction is completed.

We calculated the differences between construction land prices and land coupon prices in supply regions (Table 3) and the difference between construction land prices and farmer compensation for demand regions (Table 5). Rents are typically several times higher than the land price. The maximum construction rent was more than 40 times above land prices in JL County located in CMFA. The average levels of $\bigtriangledown P_{si}$ and R_i/P_i were 1.71 $\times$ 10^3 yuan/m^2 and 9.39, respectively.

Table 4 indicates that the price gradient is larger in the demand areas than in supply areas, varying from 0.31 $\times$ 10^3 to 23.63 $\times$ 10^3 yuan/m^2. When compared with the average construction land rent in each county, we find that the price of urban construction land is much higher than per-unit land compensation rates, and the value gap between rural land and urban land is quite large. For example, the ratio of urban land rent to land expropriation compensation in JB is greater than 200, indicating that urban land rent in the area is as much as 200 times greater than land compensation to farmers. The average levels of $\bigtriangledown P_{dj}$ and R_j/C_j were 3.14 $\times$ 10^3 yuan/m^2 and 30.13 respectively. Fig. 4 shows the gradient ratios of demand regions and supply regions where the ratios have been divided into 4 levels.

3.3.2. Variables that impact price gradient estimates

To explore if there were systematic characteristics which led to differences between land coupon price and land rent, and between land rent and compensation, we developed a model in which county-level attributes were estimated against the results of the price gradient model. Identifying characteristics that drive differences in price gradients can help us identify areas were the land coupon market is working less than optimally. The models were run for both demand and supply regions.

Quotas for new built-up land through seizing cultivated land are determined annually according to the socioeconomic development plans and national land supply policy (Ou et al., 2014). Land quotas are first distributed by the central government to each province, followed by municipal and county levels (Li et al., 2015). The first variable that we hypothesized may have impact on the price gradient is the scarcity degree (*SD*). *SD* has two components, $\bigtriangleup m_1$ is the amount of supplementary arable land in each county before 2020, which primarily consists of land that is eligible to be converted from rural construction land to arable land, while $\bigtriangleup m_2$ is the quota of demand for occupied land in that county before 2020. The annul land quota was used because its distribution is not publicly available. Scarcity degree is the ratio of these two values:

$$SD = \Delta m_1 / \Delta m_2 \tag{3}$$

If $\bigtriangleup m_1$ is larger than $\bigtriangleup m_2$ in a county, it signifies that the country has more potential arable land than it needs to occupy, while if $\bigtriangleup m_2$ is greater, the county has greater demand and may need to receive land coupons from other counties. Areas with low *SD*, therefore, need to obtain land coupons if they wish to develop available land. On the contrary, areas with high *SD* may have surplus arable land and could have the ability to supply land coupons to other counties. Ideally, if the land coupon is working well, the sum of m_1 across all city will be equal to m_2.

SD values for all regions in this study were estimated (Table 5). *SD* for every supply county in CMFA and EMFA was found to be less than one. Similarly, for land coupon demand regions, SD in CMFA and EMFA was found to be less than one, while most other indicators were greater than one—except for in a few counties. The average scarcity degree in supply and demand regions was 2.09 and 0.96 respectively, indicating that, on average, counties in supply regions have more space for arable land, while counties in demand regions need more arable land in order to develop.

Several additional factors that may also have influence on land prices in supply and demand regions were controlled for as well (Li, 2007; Li, 2009). Included in the model were area ratio (A_i)—the ratio of land coupon and the area of urban land that can be developed is selected to describe transaction frequency since the land leasing market relatively more prosperous; Urbanization rate (*ch*)—when urbanization rate grows, farmers migrate away from rural areas and abandon their land, increasing the possibility of land coupon transactions; Fiscal revenue (*F*)—an indicator of government financial viability and largely determined by the public goods and services supplied by the government; and the ratio between the output of secondary and tertiary industries to GDP (*dj*), which describes the structure of regional industry as well. To correct for issues of multicollinearity among variables, we used a correlation test to examine the relationship between all variables. *dj* and *ch* in supply regions, and *F* in demand regions, were removed due to the high correlation (0.84 in supply regions and 0.85 in

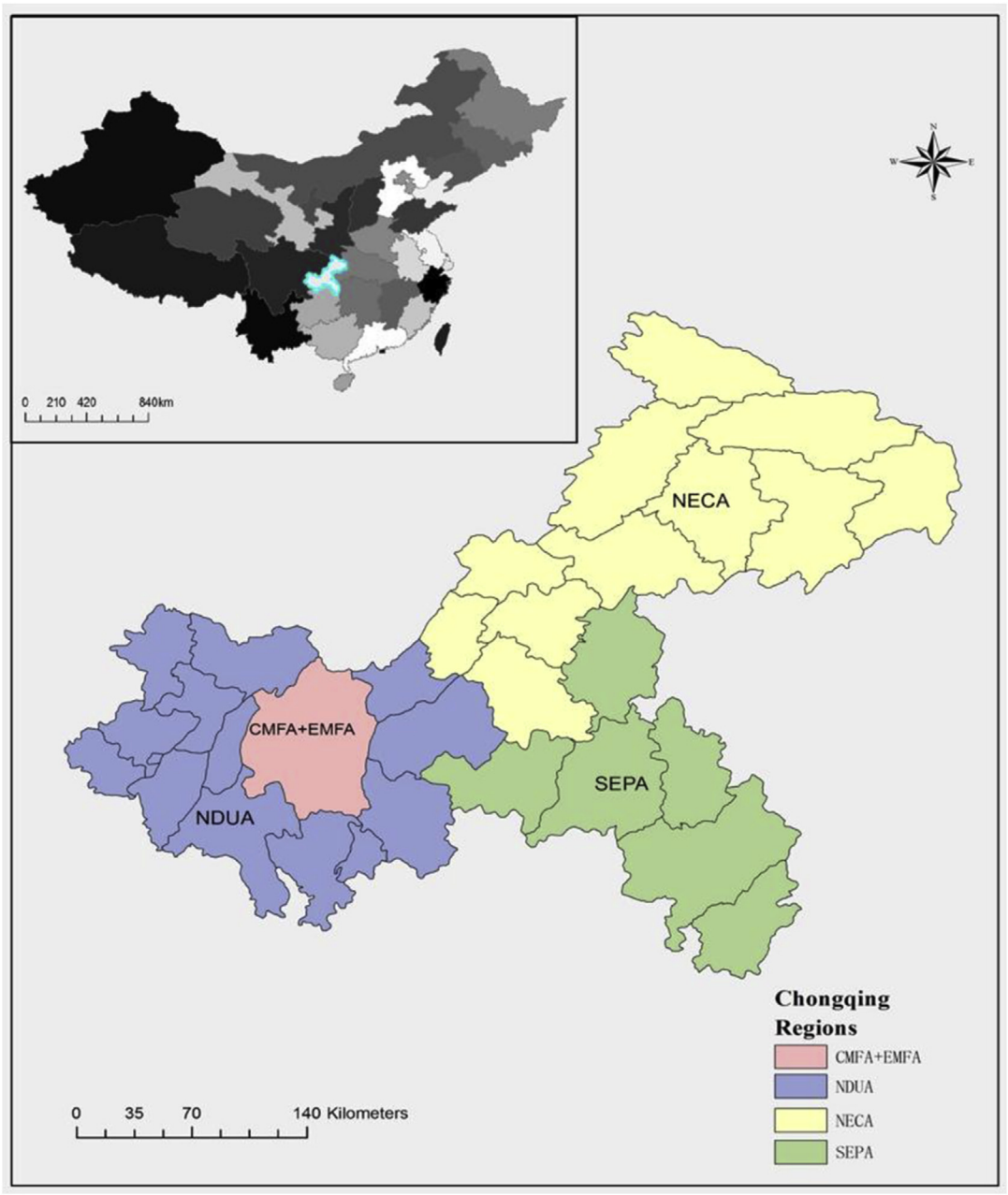

Fig. 3. Location of study area.

Table 1
Description of land coupon transactions between 2008 and 2015.

Year	Area (m^2)	Sum of all transactions (thousand yuan)	Average price (yuan/m^2)	Area (m^2)	Transactions (frequency)
2008	733 333	89 800	120	0.00	1
2009	8 266 667	1 199 350	150	600 000.00	7
2010	14 813 333	3 330 080	220	3 933 333.33	11
2011	35 266 667	12 918 270	370	19 000 000.00	6
2012	14 892 987	4 664 560	310	18 933 333.33	3
2013	13 666 276	4 523 690	330	13 666 666.67	5
2014	13 650 000	3 916 610	290	10 800 000.00	4
2015	1 164 000	326 470	280	866 666.67	1
Total	102 453 333	30 968 830	300	67 800 000.00	38

Table 2
The production and usage of land coupon in Chongqing.

Production of land coupon			Usage of land coupon		
Region	Area (km^2)	Percentage (%)	Region	Area (km^2)	Percentage (%)
CMFA + EMFA	2.33	2.29	CMFA + EMFA	45.53	67.16
NDUA	27.07	26.39	NDUA	20.33	30.00
NECA	47.53	46.40	NECA	0.47	0.69
SEPA	25.53	24.92	SEPA	1.47	2.15

Table 3
The price gradient and ratio of construction rent to land coupon price in supply counties (unit: 1×10^3 yuan/m^2).

	County	∇P_{si}	R_i/P_i		County	∇P_{si}	R_i/P_i
CMFA	YB	2.85	14.64	NECA	DJ	2.53	13.66
+	JL	8.84	42.42		KX	0.45	3.47
EMFA	BN	2.19	11.32		WX	1.13	6.68
	BB	2.47	12.89		LP	1.58	8.75
NDUA	FL	1.12	7.34		ZX	1.22	7.20
	QJ	0.97	5.93		CK	4.27	20.63
	NCH	2.17	12.81		WSH	0.17	2.17
	HCH	0.78	5.39	SEPA	SHZ	1.75	10.07
	JJ	0.58	4.12		XSH	0.67	4.84
	TL	2.01	10.19		PSH	2.97	14.73
	RC	0.09	1.85		WL	1.54	8.22
NECA	WZ	1.34	7.22		QJQ	0.04	1.58
	YY	0.92	5.90		YYX	0.58	4.25
	FJ	0.84	5.33		Average	1.71	9.39

Table 4
The price gradient, ratio of construction rent to land coupon price, and scarcity degree in demand counties (units: 1×10^3 yuan/m^2).

	County	∇P_{dj}	R_j/C_j		County	∇P_{dj}	R_j/C_j
CMFA	YB	3.04	26.99	NDUA	HCH	0.97	11.16
+	JL	9.03	78.21		JJ	0.79	9.34
EMFA	BN	2.39	21.40		TL	2.24	24.47
	BB	2.66	23.77		RC	0.31	4.21
	YZH	5.13	44.87		BSH	2.78	30.21
	NA	3.48	30.77		DZ	0.46	5.78
	SHP	0.23	2.97		TN	3.31	35.72
	JB	23.63	202.98		CHS	1.42	15.89
	DD	0.78	7.69		YCH	1.33	14.98
NDUA	FL	1.31	14.74	NECA	FD	1.65	21.16
	QJ	1.18	13.42	SEPA	WL	1.79	26.43
	NCH	2.36	25.73		Average	3.14	30.13

Table 5
Scarcity degree in supply and demand regions.

Supply regions				Demand regions			
County	SD_i	County	SD_i	County	SD_j	County	SD_j
YB	0.22	DJ	0.92	YB	0.22	TL	1.62
JL	0.09	KX	0.96	JL	0.09	RC	1.30
BN	0.62	WX	6.47	BN	0.62	BSH	1.73
BB	0.45	LP	1.93	BB	0.45	DZ	2.54
FL	0.91	ZX	2.84	YZH	0.00	TN	0.47
QJ	2.42	CK	8.03	NA	0.06	CHS	1.13
NCH	1.82	WSH	2.87	SHP	0.08	YCH	0.95
HCH	1.69	SHZ	2.61	JB	0.06	FD	1.05
JJ	1.18	XSH	1.78	DD	0.03	WL	0.84
TL	1.95	PSH	3.09	FL	0.91	–	–
RC	1.62	WL	0.84	QJ	2.42	–	–
WZ	0.95	QJQ	1.12	NCH	1.82	–	–
YY	2.61	YYX	3.20	HCH	1.69	–	–
FJ	3.23	Average	2.09	JJ	1.95	Average	0.96

demand regions). Price gradient models with the above variables were developed using weighted least square (WLS) regression and a quadratic term, as seen in Models 1 and 2.

$$\nabla P_{si} = \partial_0 + \partial_1 SD_i^2 + \partial_2 SD_i + \partial_3 A_i + \partial_4 F_i + \varepsilon_i \quad \text{(Model 1)}$$

$$\nabla P_{dj} = \beta_0 + \beta_1 SD_j^2 + \beta_2 SD_j + \beta_3 dj_j + \beta_4 \mathrm{ch}_j + \mu_j \quad \text{(Model 2)}$$

In which, ∂, β are the coefficients to be estimated, $i = 1,2,3 \ldots\ldots n$, $j = 1,2,3 \ldots\ldots q$, where n and q identify supply counties and demand counties respectively.

3.4. Results

Estimation parameters for the regression model in supply and demand regions were calculated in Statistics Analysis System(SAS) and are presented in Table 6. The results from Model 1 show that scarcity degree impacts price, usually negatively, but in Model 2, there is a U-shaped relationship between price difference and scarcity degree. We also calculated the thresholds for $\bigtriangledown P$ and SD for both models (Table 6) and found that the value of SD_i was below the threshold for all locations except for WX and CK, which are remote counties located in the Northeastern Ecological Conservation Area (NECA). This suggests that SD is negatively correlated with $\bigtriangledown P_s$ and that the as the degree of scarcity lowers, the value gap between coupon price and land rent increases. Considering that coupon prices across counties are relatively stable for any given year (see Table 4), this value gap is likely influenced by land rent. Counties with greater quotas of development occupation on arable land($\bigtriangleup m_2$) have higher demand for development land, which can lead to a higher land rent.

The threshold of SD_j in the demand regions was 0.76 (i.e., <1), which means that in development spillover areas, SD is negatively related with $\bigtriangledown P_d$. This indicates that, as the degree of scarcity drops, the value gap between compensation for acquisition (C) and land rent (R) rises. In addition, the majority of counties with an SD value less than 0.76 were located in the Core Metropolitan Function Area (CMFA) and Extended Metropolitan Function Area (EMFA)—a result of high land rents in heavily-urbanized locations. For all counties with an SD value greater than 0.76, a positive correlation was found between C and R, likely resulting from a faster rate of decrease for wages compared to the rate of decrease for land rents.

Indeed, $\bigtriangledown P_s$ had a significantly negative correlation with A, and strongly positive correlation with F, which indicates that as more land coupons enter into a market, the price gap between land coupons and land rents decreases—as government revenue increases, land rents increase as well. In demand regions, there was a significantly positive correlation between urbanization rate (ch) and $\bigtriangledown P_d$, suggesting that $\bigtriangledown P_d$ will grow as per unit ch decreases. Moreover, the value gap will decline because of the function of secondary and tertiary industries to GDP (dj).

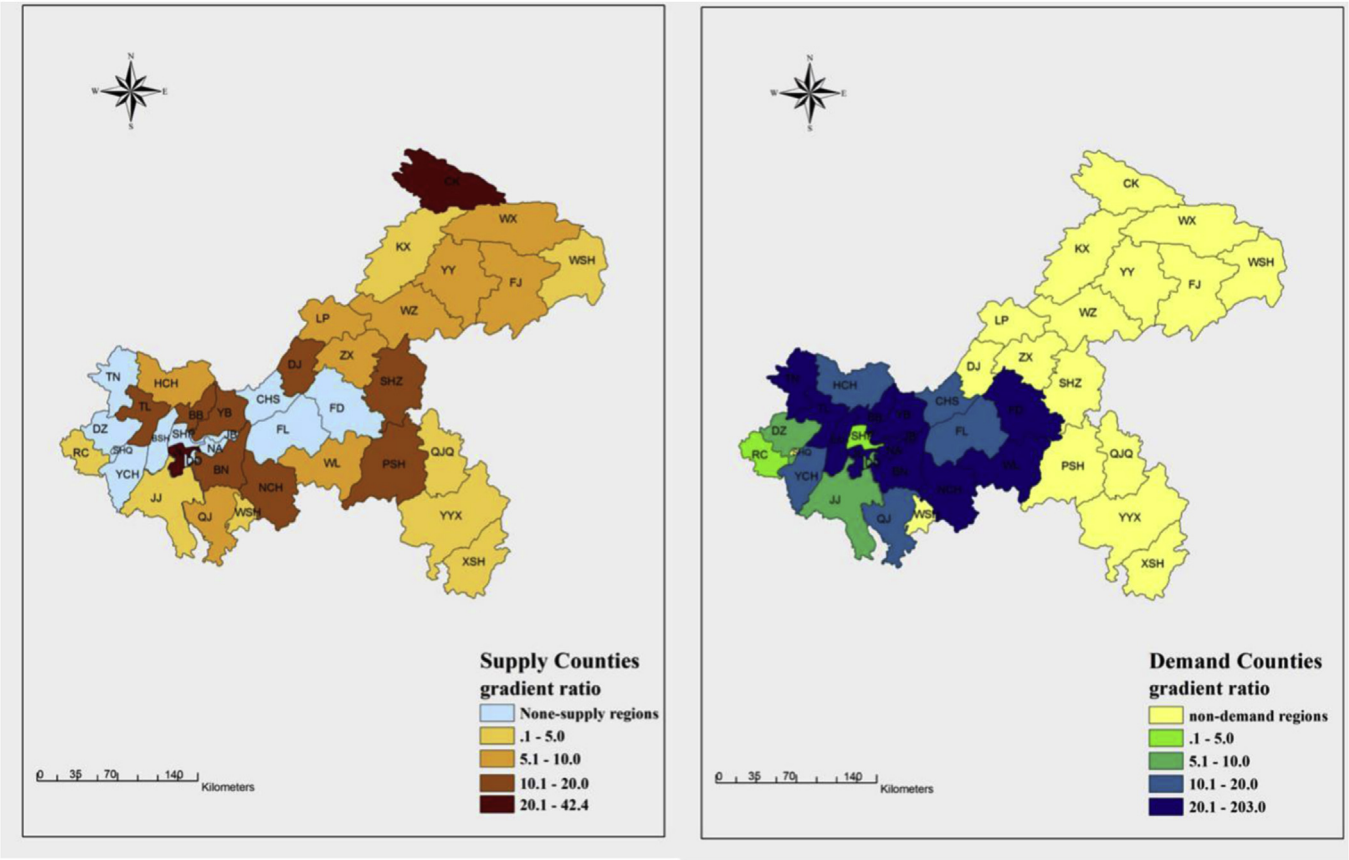

Fig. 4. Gradient ratios in supply and demand regions.

Table 6
Estimation results of land coupon price gradient models.

Model 1 (supply regions)		Model 2 (demand regions)	
Variables	Estimates	Variables	Estimates
Intercept	2.59 (3.11) ***	Intercept	7.68 (6.52)***
SD_i^2	0.15 (2.85) ***	SD_j^2	12.71 (5.62)***
SD_i	−1.11 (−2.57) **	SD_j	−19.44 (−7.03)***
A_i	−25.29 (−2.18) **	A_j	–
dj_i	–	dj_j	−2.41 (−2.37) **
ch_i	–	ch_j	4.41 (6.74) ***
F_i	43.18 (2.93) ***	F_j	–
F value	8.01 (Pr > F) = 0.004	F value	60.33 (Pr > F) < 0.0001
R-square	0.59	R-square	0.92
Threshold	$SD_i = 3.61$, $\bigtriangledown P_s = 0.59 - 25.29A_i + 43.18F_i$	Threshold	$SD_j = 0.76$, $\bigtriangledown P_d = 0.24 - 2.41dj_j + 4.41ch_j$

P values are in in parentheses, ***denotes $P < 0.01$, ** denotes $P < 0.05$.

4. Conclusions and policy implication

4.1. Conclusions and discussions

In this study, we have presented an overview of the Chongqing land coupon program, one of the oldest and largest land coupon programs in China. We compiled data for all Chongqing land coupon transactions between 2008 and 2015 and calculated the difference between coupon prices and urban rents, as well as between urban rents and compensation to farmers. The results contribute valuable insights into emerging land coupon programs in China, and two important conclusions can be made. First, land coupons do not sufficiently bridge the value gap that was observed between rural and urban lands. Second, the differences between the land coupon prices, urban rents, and compensation rates are influenced by many socioeconomic variables, most significantly by scarcity degree.

An interesting finding is the relationship between price difference and scarcity degree. Regression results showed a generally negative relationship between price difference ($\bigtriangledown P$) and scarcity degree (SD) in supply regions, indicating that for most counties higher levels of (SD) lead to smaller value gaps. This implies that higher land coupon prices are paid in areas where we would expect higher demand, just as a market system would predict. The value gap is also influenced by other indicators, such as area ratio and fiscal revenue in supply regions. In demand regions, however, there

is a U-shaped relationship between $\bigtriangledown P$ and *SD*, which is consistent with results from applying an environmental Kuznets Curve for rural-urban land conversion, as is seen in a study conducted by Li et al. (2014). Their analysis reveals that an inverted U-shape relationship existed between arable land occupation by construction and economic growth. Therefore, in combination with equation (3) —where *SD* is the reciprocal for $\bigtriangleup m_2$ (occupation on arable land) multiplied by $\bigtriangleup m_1$—a U-shaped relationship is observed. If a sufficient number of samples were available (i.e., n > 38, the number of sample in this study), the pronounced U-shape relationship between $\bigtriangledown P$ and *SD* may be clearer in both supply and demand regions.

The increase of development pressure (*SD*) in supply regions raises the price of land coupons. With the higher level of development pressure, a wider value gap between rural land and urban land in demand regions exists. Therefore, it appears that the portion of the land coupon sales that goes to peasants is far less than the value that some developers may be willing to pay for such coupons. It may be the case then that the peasants cannot get the whole value of land coupon, let alone the value of reclaimed rural residential land. We also found that while the land coupon did increase payments to rural and urban farmers alike, the payments were much greater to rural peasants. It is unclear why this gap exists, but it is a reason of concern. This is especially true since the government is the purchaser of this land and is potentially underpaying urban farmers.

Land coupon programs in China are a type of TDR program with a unique historical context and goals for future development. Since there is no official rural market, it is impossible to collect the official market prices of rural assets. For this reason, a revalorization of rural lands is increasingly important. Comparing the differences between coupon price and land rent suggests a greater value gap between compensation and land rent than was previously understood. This finding supports the notion that land coupon programs are better-equipped than land acquisition systems for activating rural assets, even if a pricing standard of TDR is needed to improve the land coupon system.

4.2. Policy implication

In regard to future policy-making, we did not find that land coupon programs can activate rural assets entirely, however, they can increase market values in favor of rural peasants. Because the value gap between compensation and land rent in demand regions is much higher than the value gap between land rent and coupon price in supply regions, it appears that urban farmers may be the least-served by this program. In order to reduce this gap, we suggest that compensation rates to urban farmers increase. Since the government plays an indispensable role in the process of state acquisition on rural lands, it has the power to change compensation levels and make the program more just. While the Chongqing land coupon is a significant step toward establishing a unified rural-urban land market that can address the conflicts between land quotas, there are still clear distributional issues that require future improvement. In particular, a rule about pricing of TDR should be introduced to set the prices both in supply and demand regions. When the supply and demand prices balance, the equilibrium price is the value of a land coupon.

In addition, because the land coupon process focuses only on the area of land coupons instead of the quality of land, the land coupon cannot guarantee agricultural yields will remain stable. Thus we suggest that cultivated land quality should be included in the land coupon transaction. Adding land quality to the land coupon program, would allow for the program to realize the real value of rural construction land, protect food security and reinvigorate rural assets. In practice, local governments and related agencies need to evaluate both reclaimed rural lands and urban farmland when setting prices for both demand and supply regions.

Furthermore, we suggest that the demand-supply of land coupon should be linked with farmers' welfare both in demand and supply regions to narrow the value gap between rural-urban areas. From the value gap in demand regions, we find that the landless farmers in demand regions do not share the value of land coupon benefits at all, which could make them less willing to participate in such a program. In supply regions, it is important to consider that increasing prices may encourage farmers to reclaim their residential lands, which could potentially lead to an over-saturated land coupon market. Over time, any unbalance between supply and demand in land coupons will decrease their value and negatively affect rural welfare.

Finally, to make land coupon programs in China more effective and efficient, we suggest that the government must carefully consider the scarcity thresholds when determining land quotas. When the government distributes the annual land quotas, the potential of development and reclamation are the most important two factors. However, it is hard to measure these capacities accurately and scientifically in reality, which makes process of distribution full of uncertainty and randomness to some extent. Therefore, the scarcity thresholds can help the governments to distribute quotas in reverse and improve the Annual Quotas Distribution System as well.

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