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Analysis of rural transformation development in China since the turn of the new millennium

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A B S T R A C T

Since the turn of the new millennium, the Chinese central government has focused significant attention on substantially improving rural residents' well-being and achieving the coordinated development of urban and rural areas. This paper examines China's *rural transformation development* based on three assessing indicator systems (the *rural development level*, the *rural transformation level*, and the *urban–rural coordination level*), using government socioeconomic data from 2000 to 2008. Spatial and statistical analyses, supported by SPSS 13 and ArcGIS 9.2 software, show that rural China has experienced universal and intense transformative development since 2000. China's urban–rural coordination development declined greatly between 2000 and 2008. Our analysis shows that rural transformation development that corresponds to a certain rural development level will lead to the effective development of regional rural systems and an improved urban–rural relationship. This paper suggests that more attention needs to be paid to the powerful factors that fuel rural transformation development, especially in coastal China, to coordinate urban–rural development under the pressure of rapid industrialization and urbanization in the new century. Given the multiscale nature of regional inequalities in rural transformation development, improving rural development policies aimed at various rural transformation development types might be the most effective way to shape a more coordinated urban–rural development pattern in China.

Introduction

In the late 20th and early 21st centuries, rural restructuring has been identified in Western Europe, North America, and Israel in the Middle East (Capo, 1995; Cloke, Goodwin, & Milbourne, 1997; Mahon, Fahy, & Cinnéide, 2009; Nelson, 2001; Sofer & Applebaum, 2006). At the same time, such transformational development has also taken place in the rural areas of developing countries, such as China (Ahmed, 1993; Cai, 1999; Su, Jiang, Zhang, & Zhang, 2011), India (Dandekar, 1988), the Philippines (Gibson, Cahill, & McKay, 2010), Zimbabwe (Kamusoko, Aniya, Adi, & Manjoro, 2009), and Ecuador (López & Sierra, 2010). This rapid and radical rural restructuring is often referred to as *rural transformation development* (RTD) (Cai, 2001; Liu, 2007). In most developing countries, RTD is usually characterized by changes in agricultural intensity, crop selection patterns, farmland, land productivity and farm income, labor and technological productivity, and major improvements in rural housing and economic and social conditions resulting from industrialization and urbanization (Ali, 2007; Cai & Smit, 1994; Hara, Takeuchi, & Okubo, 2005; Long, Heilig, Li, & Zhang, 2007; Long, Liu, Wu, & Dong, 2009; Long, Tang, Li, & Heilig, 2007; Liu, Wang, & Long, 2010; Long, Zou, & Liu, 2009; Liu, Zhang, & Guo, 2010; Müller, Müller, Schierhorn, & Gerold, 2011; Nepal & Thapa, 2009; Yu, Zang, Wu, Liu, & Na, 2011).

This paper investigates rural inequalities and development policies in contemporary China. Because there are extreme regional discrepancies in both socioeconomic development and geographical and biophysical conditions in China (Long, Liu, Li, & Chen, 2010), improving rural residents' well-being is a popular and political concern. The aims of this paper are as follows: (1) to establish indicator systems that can measure RTD in China during the 2000–2008 period; (2) to analyze the spatiotemporal characteristics and internal mechanisms of China's RTD in the early 21st century; and (3) to discuss some of the major implications for achieving coordinated urban–rural development in the future.

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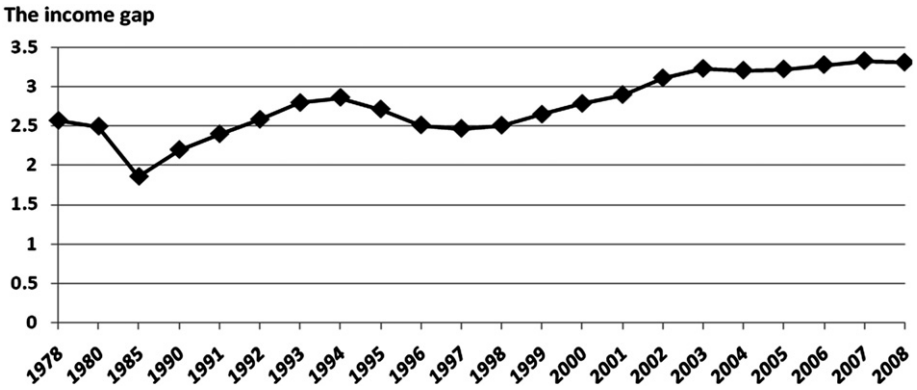

Fig. 1. The income gap between rural and urban residents in China, 1978–2008. The income gap was calculated by dividing the per capita disposable income of urban households by the per capita disposal income of rural households. Source: NBSC, 2009.

China is a nation with strong rural roots. Despite rampant urbanization, 56% of its population still lives in rural areas, and the national economy has been built on agricultural foundations since ancient times. However, China has transformed rapidly since Deng Xiaoping launched the economic reforms of 1978. The traditional centralized economy changed to a market-based economy, and the economy, which was once primarily agricultural, has become increasingly urban and industrial. During this period, the RTD process and its results have been influenced by national macroeconomic development strategies. Since 1978, RTD in China has been linked to three macroeconomic development strategies: implementing a household responsibility system, developing township and village enterprises (TVEs), and building a new countryside. These strategies have resulted in tremendous changes in the rural population, lifestyles, employment structure, industrial structure, community organization, culture, and public transport accessibility (Goodman, 2008; Long et al., 2010; Putterman, 1997; Tilt, 2008; Unger, 2002, 2006; Unger & Chan, 1999; Xu & Tan, 2002; Zhang, Rozelle, & Huang, 2001).

Since the economic reforms of 1978, agriculture and the countryside have contributed greatly to, and have made substantial sacrifices for, the development of industries and cities in China. This urban development has caused a series of problems that affect China's social and economic development (Cai & Smit, 1994; Long et al., 2010; Xu & Tan, 2002). The most notable issue is a shift in the economic balance and the widening of the prosperity gap between urban and rural areas. The income gap between rural and urban residents has increased from 2.57 to 1 in 1978 to 3.31:1 in 2008, and this trend has strengthened since the turn of the new millennium (Fig. 1). On one hand, the income gap is reinforced by long-standing urban–rural inequalities. Farmers are also disadvantaged by the disparity between artificially low prices for agricultural products and the high cost of industrial goods. On the other hand, since the turn of the new millennium, China's economic and social development has entered an important new period. China's fast-growing economy and stronger position in the global community have enabled industries to support agriculture and cities to support the countryside. Under these circumstances, Chinese central government has implemented "urban–rural coordination development" (*Chengxiang Xietiao Fazhan*) since the turn of the new millennium, which has resulted in significant RTD.

Earlier, uncoordinated urban–rural development created problems with agricultural production, low farm incomes and the need for broader rural development, all of which have become major political issues. Since 2004, the Chinese central government has recognized the importance of rural development, and it devoted its Number One Policy Document[1] to rural issues for each of the next seven years. These documents successively addressed the following: increasing farmers' incomes (2004); improving agricultural production capacity (2005); advancing the "building a new countryside" scheme (2006); developing modern agriculture (2007); resolving rural problems (2008); stabilizing agricultural prices and increasing farmers' incomes (2009); and strengthening agricultural and rural development (2010). Together, these policy actions contributed to the overarching goal of "building a new countryside", which targeted five major objectives (Long et al., 2010): advanced production; improved livelihoods; cultural and ethical progress; clean and tidy villages; and efficient management.

Rural development has traditionally been seen as a vague term that is difficult to specify, measure and evaluate (Kassioumis et al., 2004). Today's rural economy and its social system are much more diverse, complex, sophisticated and global than those of the last century (Kennedy, Thomas, & Glueck, 2001). Rural development is now seen as a multilevel, multiactor and multifaceted process that requires an understanding of the agricultural developmental model, the relationship between agriculture and society, the regional socioeconomic structure and rural economic status, individual farm households and their behaviors, and local policies and institutions (Muilu & Rusanen, 2003; van der Ploeg et al., 2000; Rizov, 2004).

Issues related to measuring rural development have attracted the interest of a wide variety of researchers. During the 1970s and 1980s, an index of rurality for local government districts in England and Wales was developed to identify some of the differences between degrees of rurality. This index included such indicators as population, household amenities, occupational structure, commuting patterns, and the distance to urban centers, and was constructed using a range of statistics from the 1971 and 1981 censuses (Cloke, 1977; Cloke & Edwards, 1986). It is important to note that Paul Cloke (1994: 156) himself has since drawn critical attention to the inappropriate or naive method of indexing and categorizing the rural in this way. He has written extensively on representations of the rural, social constructionist approaches to rurality, and considerations of how the rural is produced by social, cultural, material and economic relations (see also Woods, 2011). A similar rurality degree index (RDI) was recently established to distinguish degrees of rurality in eastern coastal China (Long, Zou, et al., 2009). A corresponding index has also been developed to measure and explain both urban and rural development (Liu, Zhang, & Zhang, 2009; Mann, 2009).

[1] Usually, the Number One Policy Document (*Zhongyang Yihao Wenjian*) establishes the central government's key policy task for the coming year.

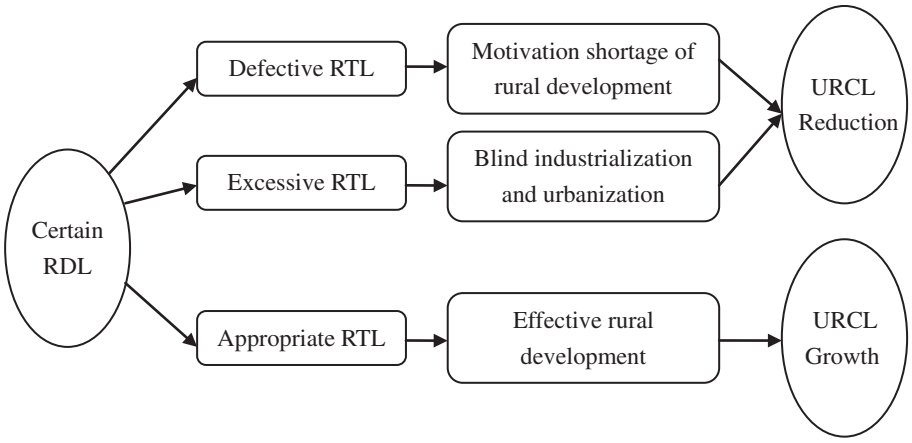

Fig. 2. Three dimensions measuring RTD: RDL, RTL, and URCL.

In this paper, related development indexes were established to examine *rural transformation development* in China and explore the future possibilities of achieving more coordinated and balanced urban–rural development.

Rural transformation development

A useful theoretical approach to rural development considers how local factors and external driving forces interact to determine the development of the rural economic system (Terluin, 2003). This relationship between the local, rural system and the external system – in particular, the links between the rural and urban economies and cultures – are important strands in current rural development research (Murdoch, 2000). For instance, rural agricultural development has been seen to play an important role in regional industrialization and urbanization by guaranteeing the supply of food and raw materials needed to sustain industrialization. This kind of role, in turn, leads to the transition and transformation of rural areas (McGee, 2008).

RTD is, in essence, a term that captures changes in traditional rural industries, the employment consumption structure, and the social structure. These changes signify a transformation from previously isolated urban and rural economic structures toward more coordinated urban–rural development. Such transformation radically changes the urban–rural relationship and the relationship between agriculture and industry (Liu, 2007). RTD assessment involves measuring three major components: the development of a distinctively rural economic system; the transformation of rural social, economic and consumption structures; and the improvement of the urban–rural relationship. Accordingly, this paper establishes three evaluation dimensions to systematically diagnose the RTD in a given region: the *rural development level* (RDL), the *rural transformation level* (RTL), and the *urban–rural coordination level* (URCL).

The RDL reflects to both the rural socioeconomic base level before RTD and the integrated effects of RTD on the rural system's social, economic, and cultural values. The RTL reflects the degree and rate of change in rural socioeconomic and consumption structures. The URCL reflects the relative allocation of regional resources to urban and rural systems and the integrated effects of RTD on socioeconomic development at the regional level. The URCL can be used to judge the effectiveness of RTD; namely, well-ordered RTD can improve the URCL by promoting the optimal allocation of regional resources between urban and rural systems, while disordered RTD can intensify the relative deprivation of the rural system.

RTD is the result of rural socioeconomic development at a certain stage, and the RTD of a given region needs to adapt to that regions RDL baseline. Generally, a low regional RDL means that the regional rural system has not accumulated enough developmental capital, agricultural technology, human capital, and rural production infrastructures and service facilities to effectively support developmental transformation. In this situation, if the RTD is pushed forward recklessly, the original endogenous rural development would be disturbed, and changes to the rural subsystem will not improve rural development capacity. As a result, urban and rural development will be uncoordinated, as the development of the rural system has been restricted. However, when the regional RTL is appropriate and the rural economic transformation mainly focuses on the agricultural infrastructure or production technology improvements, the regional RDL will improve significantly, and the regional URCL will also be positively impacted.

While some regional rural systems have experienced relatively rapid development and an improved RDL, the development of the rural system does not always keep pace with the existing development pattern. Under such conditions, RTD should be accelerated or emphasized to improve the rural system structure and ensure a more satisfactory speed for rural development. At the same time, some incentive policies (i.e., those concerning rural industrial development, employment support, and technological improvement) need to be introduced to optimize the rural system's socioeconomic structure and promote coordinated urban–rural development.

With continuous socioeconomic development, regional RDL is enhanced, thus promoting the transformation of the rural socioeconomic structure, which will ultimately affect the progress of regional *urban–rural coordination development*. Accordingly, the initial RDL conditions can influence the consequent RTL and may ultimately change the urban–rural relationship and the regional development pattern (Fig. 2).

Materials and methods

Data source and processing

Because regional RTD is composed of three dimensions (RDL, RTL, and URCL), indicator systems corresponding to each dimension were established to comprehensively measure them. The indicators for RDL measurement (see Table 1) reflect changes within the rural society, economy, culture, resources, and the environment (Long, Zou, et al., 2009). Considering the availability of relative socioeconomic data, we selected eight representative indicators belonging to three rule layer factors: rural economic development, agricultural production investment, and rural livelihood. All of these

Table 1
Indicator system for rural development level (RDL) assessment.

Rule layer factors (weight)	Indicator layer factors (weight)	Definition
Rural economic development (0.383)	Agricultural output value level (0.542)	Gross output value of farming, forestry, animal husbandry and fishery per capita
	Productivity of rural labor (0.458)	Gross agricultural output value divided by the laborers employed in farming, forestry, animal husbandry and fishery
Agricultural production investment (0.263)	Power investment (0.344)	Gross power of farming mechanism per ha
	Fertilizer investment (0.310)	Gross fertilizer use per ha
	Irrigation index (0.346)	Irrigated farmland area divided by the total area of farmland
Rural livelihood (0.354)	Rural electricity consumption (0.283)	Electric power consumption per capita in the rural area
	Rural income level (0.363)	Per capita net income of rural households
	Rural consumption level (0.354)	Per capita consumption expenditure of rural households

factors can be analyzed using analytic hierarchy process (AHP) methods (Table 1). All of the indicators in Table 1 have positive effects on regional RDL assessment.

Essentially, rural transformation is marked by changes in the rural area's internal industrial, employment and consumption structures and corresponding changes in the rural population and land-use structure and intensity. Therefore, six indicators were chosen to assess RTL (Table 2). Three general and intuitive indicators were chosen to comprehensively measure the degree of urban–rural coordination in society, economics, resources, and the environment, and these were used to assess the URCL (Table 3). All of the indicators in Table 3 have positive effects on regional URCL assessment.

Data for the indicators in Tables 1–3 are taken from China's regional economic statistical yearbook, in which prefecture-level city is the data collection unit, and naturally the prefecture-level city is the assessment unit of this study. Because we aimed to describe and compare all of these data from 2000 to 2008 for the whole country, we made sure that any data used were from unified statistical sources and that the economic data were based on comparable pricing, that is, all of the original economic data from 2008 were calculated using the constant price from 2000. Semi-structured interviews with geography and sociology experts and government officials for rural development were conducted to determine the weights for the rule layer factors in Table 1 and all of the indicators in Tables 1 through 3.

Methods

Because the socioeconomic data for the various indicators in Table 1 are in different units, they needed to be transformed into comparable common units by normalizing all measures, using Equation (1):

$$X'_{ij} = \frac{X_{ij} - X_{i.\min}}{X_{i.\max} - X_{i.\min}} \quad (1)$$

Where X'_{ij} is the standardized value of the indicator; ij means the indicator i in the rule layer j; X_{ij} is the value of the indicator ij; $X_{i.max}$ is the maximum value of indicator ij for all prefectures; and $X_{i.min}$ is the minimum value of indicator ij for all prefectures.

The indicators in Tables 2 and 3 are relative indices without dimensions. To render them comparable, we needed to range their values from −1 to 1 using the general normalization method, according to Equation (2):

$$X'_i = \frac{X_i}{X_{i.\max}} \quad (2)$$

Where X'_i is the standardized value of the indicator i; X_i is the value of the indicator i; and $X_{i.max}$ is the maximum value of the absolute value of the indicator i for all prefectures.

To compare the RDL, RTL and URCL for all of the prefectures, the same data type from different prefectures between 2000 and 2008

Table 2
Indicator system for rural transformation level (RTL) assessment.

Indicator (weight)	Definition	Explanation
Urbanization level change rate (0.209)	$\frac{UL_l - UL_e}{UL_e}$	UL_l = the proportion of the nonagricultural population in the total population for the later period; UL_e = UL for the early period. A positive indicator: the higher the value, the higher the RTL.
Industrial structure change rate (0.204)	$\frac{IS_l - IS_e}{IS_e}$	IS_l = the proportion of the output value of primary industry in the total gross domestic product (GDP)[a] for the later period; IS_e = IS for the early period. A negative indicator; the lower the value, the higher the RTL.
Employment structure change rate (0.200)	$\frac{ES_l - ES_e}{ES_e}$	ES_l = the proportion of laborers employed in farming, forestry, animal husbandry and fishery among the total laborers for the later period; ES_e = ES for the early period. A negative indicator; the lower the value, the higher the RTL.
Consumption structure change rate (0.174)	$\frac{CS_l - CS_e}{CS_e}$	CS_l = the Engel coefficient for rural residents for the later period; CS_e = CS for the early period. A negative indicator; the lower the value, the higher the RTL.
Grain-farmland index change rate (0.123)	$\frac{GI_l - GI_e}{GI_e}$	GI_l = the proportion of grain-crop area in the total crop area for the later period; GI_e = GI for the early period. A negative indicator; the lower the value, the higher the RTL.
Multicropping index change rate (0.090)	$\frac{MI_l - MI_e}{MI_e}$	MI_l = the proportion of the crop area in the area of farmland for the later period; MI_e = MI for the early period. A positive indicator; the higher the value, the higher the RTL.

[a] Note: In China, economic activities are categorized into the following three strata of industry: primary industry refers to agriculture, forestry, animal husbandry and fishery and services supporting these industries; secondary industry refers to mining and quarrying, manufacturing, production and supply of electricity, water and gas, and construction; tertiary industry refers to all other economic activities not included in the primary or secondary industries (NBSC, 2009).

Table 3
Indicator system for urban–rural coordination level (URCL) assessment.

Indicator (weight)	Definition
Rural–urban income gap (0.433)	Dividing the per capita net income of rural households by the per capita disposable income of urban households
Urban–rural consumption structure comparison (0.304)	Dividing the Engel coefficient of urban residents by that of rural residents
Industrial labor productivity comparison (0.263)	Dividing the productivity of laborers employed in farming, forestry, animal husbandry and fishery by that of laborers employed in other industries

were normalized using the same extremum. Using the same data type guarantees that the final RDL, RTL, and URCL for different prefectures are spatially and temporally comparable.

After multiplying each negative indicator by −1, we used the weight and normalized value of each indicator to calculate the RDL, RTL, and URCL scores for each prefecture, using Equations (3)–(5):

$$RDL = \sum_{j=1}^{n}\left(\sum_{i=1}^{m} X'_{ij} \times W_{ij}\right) \times W_j \quad (3)$$

$$RTL = \sum_{k=1}^{t} X'_k \times W_k \quad (4)$$

$$URCL = \sum_{k=1}^{t} X'_k \times W_k \quad (5)$$

Where X'_{ij} is the standardized value of the RDL indicator; W_{ij} is the weight for indicator layer factor ij; W_j is the weight of rule layer factor j; n is number of the rule layer factors; m is the number of indicators in each rule layer; is the standardized value of RTL or URCL indicator k; W_k is the corresponding weight of the RTL or URCL indicator; and t is the number of RTL or URCL indicators.

Spatial analyses

There are obvious regional discrepancies in physical conditions and socioeconomic development throughout China (Long et al., 2010). According to Chinese statistical definitions, China has four regions: the eastern region, the central region, the western region, and the northeastern region (Fig. 3). The eastern region includes Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan; the central region includes Shanxi, Anhui, Jiangxi, Henan, Hubei, and Hunan; the western region includes Guangxi, Inner Mongolia, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Ningxia, Qinghai, and Xinjiang; and the northeastern region includes Liaoning, Jilin, and Heilongjiang (NBSC, 2009, preface). The four statistical regions described in Fig. 2 were adopted for the spatial analysis of China's RTD.

Fuzzy spatial clustering is commonly used for spatial data analysis and territorial type divisions, and both the spatial coordinates and attribute features of each unit form the basis of the clustering analysis. In this study, we used the statistical clustering of K-mean algorithms in SPSS 13 and the spatial coordinate's extraction function in ArcGIS 9.2 to produce clustering based on both spatial and attribute data, and a high frequency of data iterative calculation were adopted to improve clustering accuracy. Finally, we used the clustering results and mapping function of ArcGIS 9.2 to determine the spatial-territorial types of RTD in China in the new century.

Results

Spatial characteristics of China's RTD

Constrained by physical conditions and general socioeconomic development, China's RDL shows a gradual, declining spatial pattern from east to west in 2000, except for the northwestern part, which had a relatively high RDL (Fig. 4). The regions with high RDL are mainly concentrated in eastern coastal China, due to its special

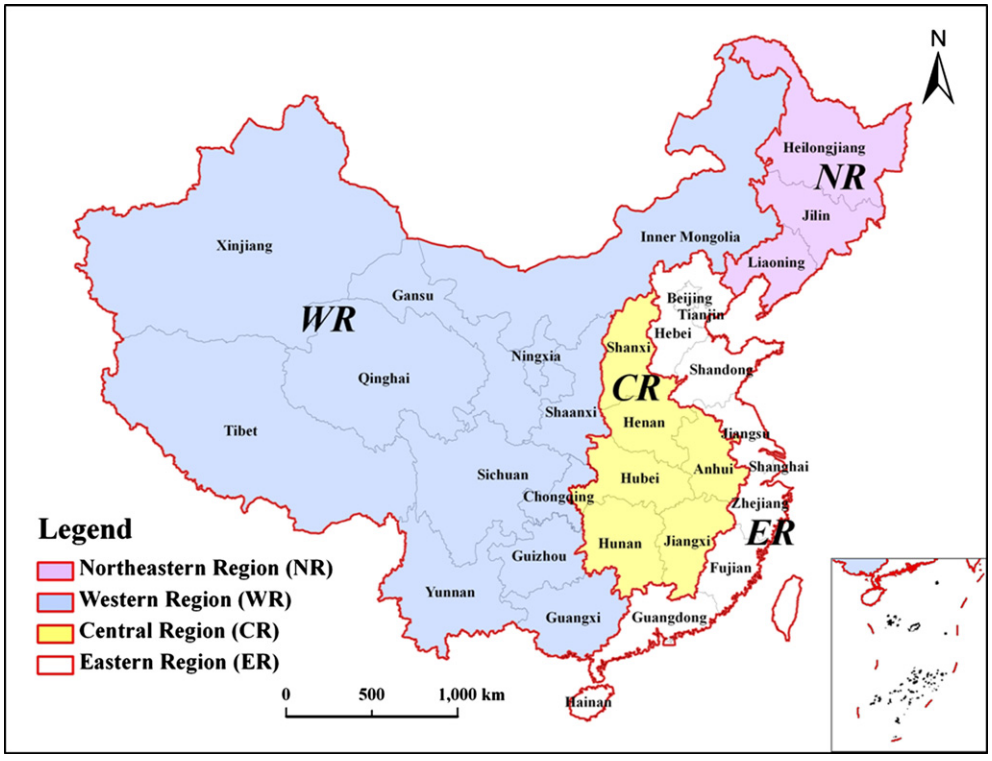

Fig. 3. The four statistical regions of China.

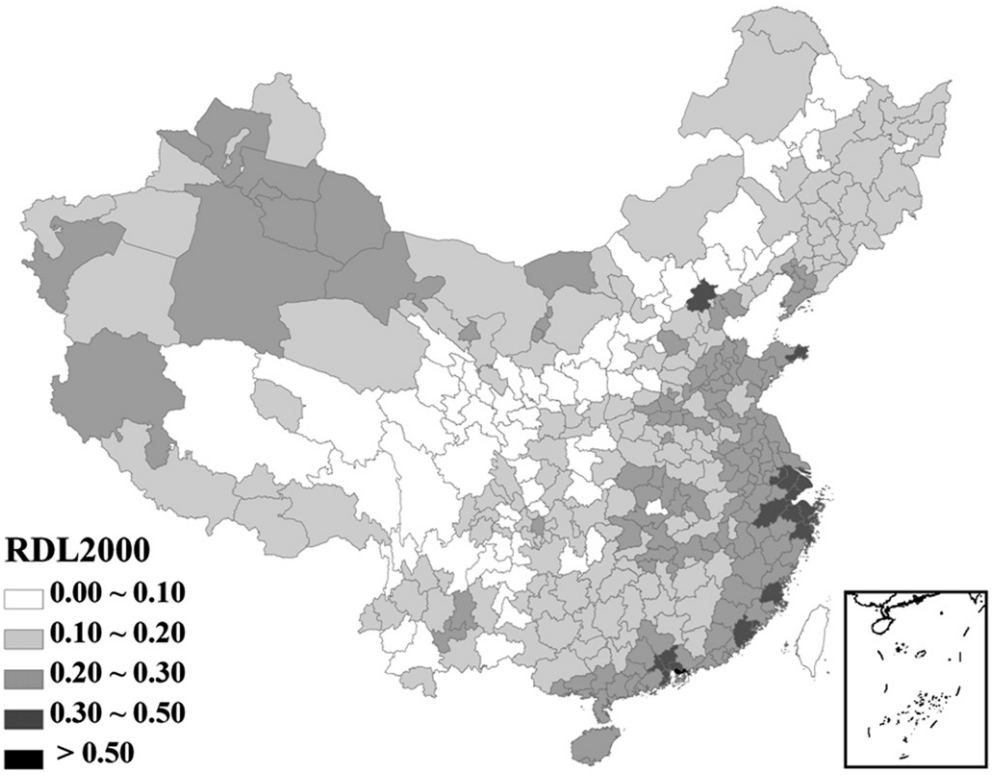

Fig. 4. The spatial pattern of China's rural development level (RDL) in 2000.

advantages (optimal physical conditions, location, and socioeconomic factors for the development of rural industry and agricultural production). Adequate financial and technological support for agricultural production is complemented by fertile farmland, distributed in plain areas, that is suitable for agricultural scale management. This support, together with the developed TVEs, has led to the high agricultural outputs and rural income levels that contributed to the high RDL.

The central region has long been one of China's main grain production bases. It has excellent agricultural production conditions, including good agricultural machinery, irrigating facilities, and capital accumulation, which have contributed to a high agricultural production level and relatively high RDL. However, due to relatively slow regional socioeconomic development, its regional agricultural production lacked adequate and sustainable capital support, which gave rise to a low RDL compared with the eastern region. In the northeastern region, large amounts of fertile farmland and superior irrigation in the great plain have led to high agricultural output. However, the northeastern region is China's traditional heavy industrial base, and it faced economic depression and industrial restructuring during the 1990s. Regional socioeconomic development was therefore unable to effectively support agricultural infrastructure improvements, resulting in nearly two decades of relative agricultural stagnation in this region and a lower regional RDL than in eastern region.

The agricultural production conditions in the western region are generally poor, due to the rugged mountainous terrain in southwestern China and extreme drought conditions in the northwest. In addition, socioeconomic development in the western region has lagged far behind that of other regions, which has led to an extremely poor agricultural infrastructure and inferior conditions for developing rural industry, ultimately resulting in a low RDL. Of course, some areas have a high RDL, but those are mainly concentrated in socioeconomic centers near big cities, or in areas with improved irrigation conditions or adequate financial support for agricultural production.

With the rapid development of China's economy, overall regional RDL shows a clear increase, with differing rates due to contrasting regional development models and policies (Fig. 5). The eastern region continues to have a high RDL rate due to support from the capital and technology that resulted from rapid economic development. The northeastern region experienced a massive industrial restructuring, guided by a national revitalization strategy for the old heavy industrial base, which brought about clear improvements in rural development and led to a high RDL growth. Compared with the northeastern region, national policies for the central and western region, such as the Central China Grow-up Program and Western China Development Program, have not generated sufficient driving forces for regional socioeconomic development and have led to an overall lower RDL growth. However, in central and western China, higher RDL growth was found in some areas near the regional economic centers, such as Chengdu, Chongqing, Wuhan, Changsha, Ordos, and Urumchi.

Since 2000, China has experienced rapid development and profound changes in socioeconomic structure, which exerted a huge influence on China's RTD (Fig. 6). In the Yangtze River delta economic area, significant reforms in TVEs development are intended to adapt to economic globalization, and an export-oriented development strategy has effectively promoted not only regional rural economic development, but also considerable progress in improving the rural system structure, which has resulted in an extremely high RTL. The governments of Beijing, Tianjin, Shandong, Hebei, and Henan actively pursued regional industrialization and urbanization, resulting in a relatively high RTL. The regions with rich energy and mineral resources achieved great progress in the mineral mining industry and pursued rapid economic growth, which led to a high RTL in the provinces of Shanxi, Shaanxi, Ningxia, Inner Mongolia, and Guizhou. In general, due to these completely

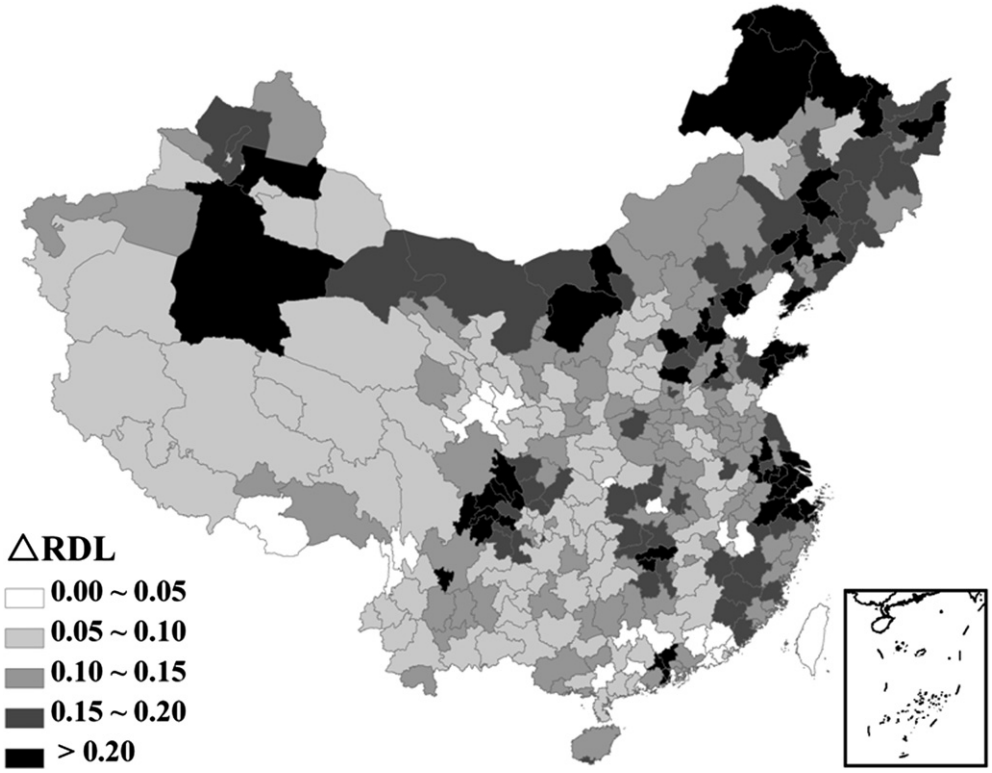

Fig. 5. The dynamic spatial pattern of China's RDL between 2000 and 2008.

different regional development models, China's RTL throughout 2000–2008 took on a complex spatial pattern (Fig. 6).

Driven by different economic development models and rural transformation intensities, the dynamic regional URCL in China from 2000 to 2008 does not show an obvious spatial pattern (Fig. 7). In general, China's urban–rural coordination development declined from 2000 to 2008; 57.9% of the regions experienced negative changes in the UCRL, and the URCL at national level decreased by 1.3%. The regions with UCRL reductions were mainly concentrated in areas with rapid economic development,

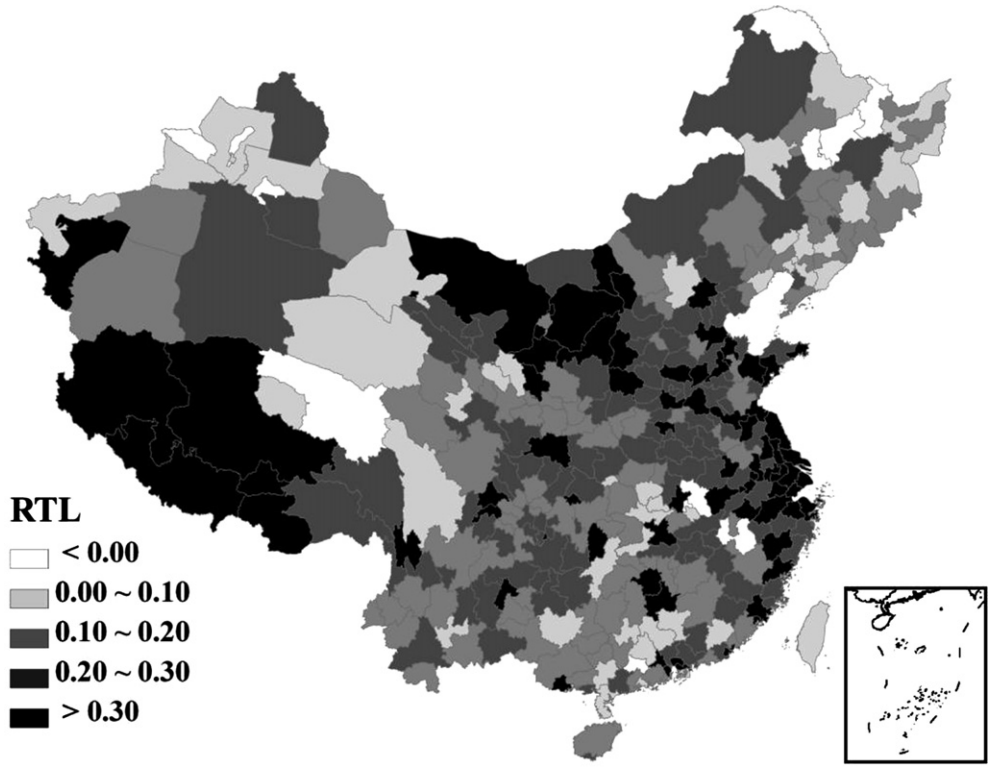

Fig. 6. The spatial pattern of China's rural transformation level (RTL) between 2000 and 2008.

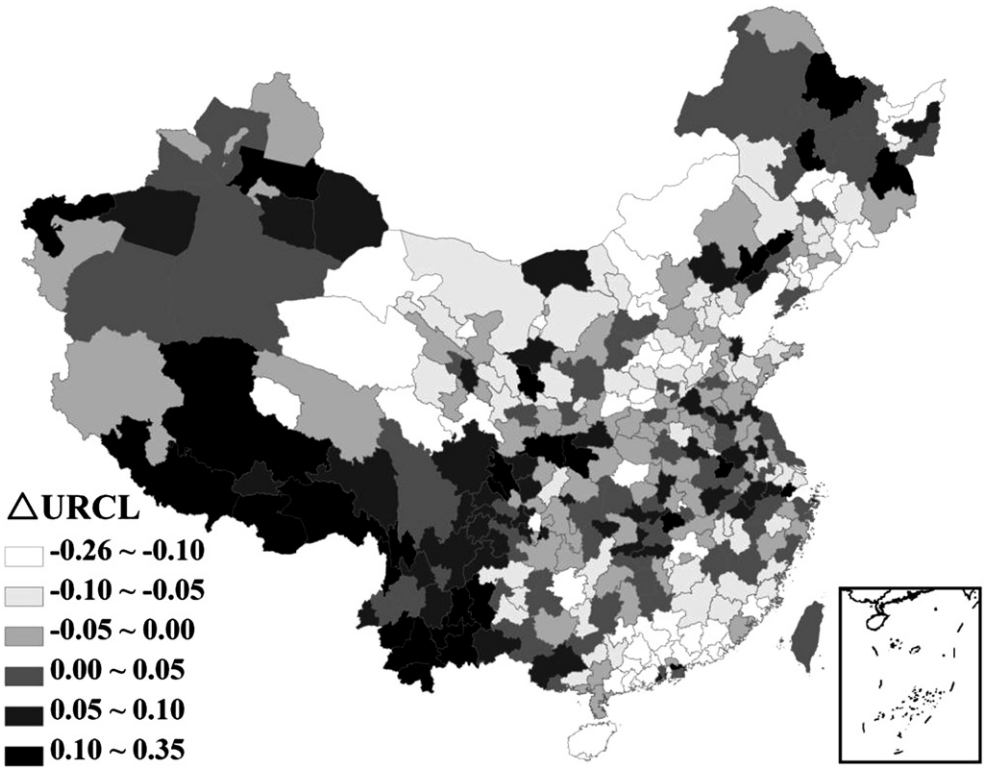

Fig. 7. The dynamic spatial pattern of China's urban–rural coordination level (URCL) between 2000 and 2008.

mostly located in the eastern and central regions or in energy and mineral mining areas where socioeconomic development has not achieved a relative balance between urban and rural areas.

Territorial types of China's RTD

Due to the complex spatial patterns of China's RTL and URCL, it is necessary to examine transformation characteristics and regional

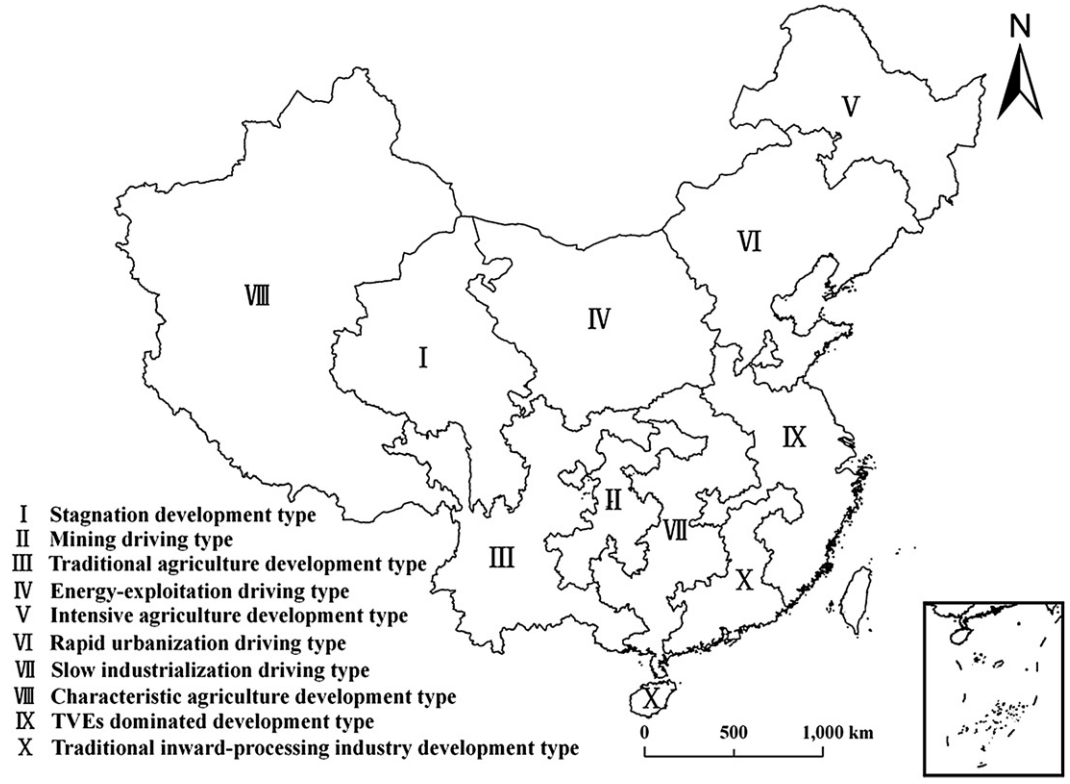

Fig. 8. The territorial types division of China's RTD.

Table 4
The transformation characteristics of each RTD territorial type.

RTD territorial type	Average initial RDL	Average RTL	Average ΔRDL	Average ΔURCL	Proportion of URCL growth units in the total units of the same type	Total units of the same type
Stagnation development type	0.108	0.063	0.104	−0.073	14.3%	7
Mining driving type	0.117	0.233	0.106	−0.029	25.0%	24
Traditional agriculture development type	0.119	0.219	0.131	0.084	100.0%	40
Energy-exploitation driving type	0.122	0.253	0.107	−0.043	23.3%	43
Intensive agriculture development type	0.124	0.072	0.178	0.018	68.8%	16
Rapid urbanization driving type	0.176	0.194	0.166	−0.053	14.5%	55
Slow industrialization driving type	0.177	0.156	0.120	−0.003	42.9%	42
Characteristic agriculture development type	0.177	0.180	0.113	0.062	70.0%	20
TVEs dominated development type	0.235	0.312	0.159	0.002	50.7%	69
Traditional inward-processing industry development type	0.271	0.199	0.124	−0.114	9.7%	31
National level	0.175	0.216	0.135	−0.013	42.1%	347

differences in physical conditions and socioeconomic development to analyze the internal mechanism of RTD in different regions. Therefore, it is useful to identify different territory types according to their characteristics, such as the regional RDL, RTL, and URCL, to analyze China's RTD patterns.

Using SPSS 13 and ArcGIS 9.2 software programs, the spatial coordinates, initial RDL, the change of RDL[2], the RTL, and the change of URCL[3] were used as the clustering factors to examine the internal mechanism of China's RTD. On the basis of the clustering results, 10 RTD territorial types were identified (Fig. 8), and their respective regional transformation characteristics (listed in Table 4) followed the sequence of initial RDL value.

Usually, different regions adopt development approaches suited to their physical and socioeconomic features to promote rapid socioeconomic development. The initial regional RDL was generally low in China, meaning that capital accumulation for agricultural production or rural development was inadequate. Along with defective or excessive RTL, this inadequacy inevitably leads to uncoordinated urban–rural development. Accordingly, the regions with low initial RDL achieve different results with different developing approaches, thereby shaping the diverse territorial types of RTD.

The mining driving type and the energy-exploitation driving type had similar developments situations: a poor agricultural base with low-intensity production investment, scarce farmland resources facing serious soil erosion risks, slow rural socioeconomic and TVE development, despite rich stores of energy and mineral resources. A similar development approach focusing on the heavy industries depended on the exploitation of resources, which promoted the rapid transfer of the employed population, social resources and capital from a rural, agricultural system to a heavy industrial urban system. As a result, rural and agricultural development stagnated because of a lack of external support, leading to low regional average RDL growth and an obvious reduction in URCL, despite a high RTL (Table 4).

Some RTD types have a relatively high RTL, but their transformation has mainly focused on changing the multicropping index and rural consumption structure, and their regional development strategies have focused on intensifying the agricultural production base instead of blindly accelerating industrialization and urbanization. These approaches promoted *urban–rural coordination development* and caused an obvious growth in URCL. For example, the intensive agriculture development type focused on developing intensive agriculture with scale management. This approach was similar to the approach of traditional agriculture development type to increasing URCL (Table 4), which focused on improving traditional agriculture. The stagnation development type is unique; it has the lowest RDL and RTL due to extreme physical conditions and low socioeconomic status. Under these conditions, blind industrialization and urbanization could not produce effective rural development and led to a low URCL.

The initial RDLs of the rapid urbanization driving type and the slow industrialization driving type were close to the average national level, but their RTLs were below the average national level, meaning they could not effectively promote regional socioeconomic development. This low level ultimately led to a reduction in URCL, especially in the rapid urbanization driving type, which was characterized by rapid socioeconomic development ($\Delta RDL = 0.166$) but uncoordinated urban–rural development ($\Delta URCL = -0.053$) (Table 4). However, there was also the special case of characteristic agriculture development type, which had a moderate RDL and a relatively low RTL; however, the development of locally appropriate agriculture promoted considerable progress in agricultural and rural development. This progress, together with appropriate industrialization and urbanization, led to a high URCL (Table 4).

Both the TVEs dominated development type and the traditional inward-processing industry development type belong to the regions with rapid economic development and universally high RDL that nonetheless faced a universal reduction in URCL, especially in the provinces of Guangdong and Hainan. In the TVEs dominated development type, the high RTL promoted rural development to a great extent, but accelerated industrialization and urbanization meant that URCL increased minimally ($\Delta URCL = 0.002$) (Table 4). Although the traditional inward-processing industry development type had the highest initial RDL (0.271), the low RTL plus accelerated industrialization and urbanization led to a drastic reduction in URCL ($\Delta URCL = -0.114$) (Table 4). Considering this result, systemic RTD should be pushed forward in the regions with developed rural and agricultural systems to avoid uncoordinated urban–rural development.

Internal mechanism of regional RTD

To distinguish the internal mechanism of regional RTD from miscellaneous assessment results, we classified the initial RDL into four grades, and RTL into five grades, based on their mathematical statistical features (Table 5). Because the number of units with high initial RDL and RTL was comparatively large and the statistical features of these units were complex, a special grade of "extremely high" was established to describe RTL. Finally, we identified the statistical features of the corresponding grades (Table 6).

Table 6 shows ΔURCL's obvious tendency to increase with increases in RTL from the low grade to high or even extremely high

[2] The value of "ΔRDL" in Fig. 5.
[3] The value of "ΔURCL" in Fig. 7.

Table 5
Specific classifications for statistical descriptions of China's RTD.

Grade	Statistical standards	Initial RDL range	RTL range
Low	(−∞, Mean − 0.5 Std[a])	(−∞, 0.135)	(−∞, 0.154)
Intermediate-low	(Mean − 0.5 Std, Mean)	(0.135, 0.175)	(0.154, 0.216)
Intermediate-high	(Mean, Mean + 0.5 Std)	(0.175, 0.216)	(0.216, 0.277)
High	(Mean + 0.5 Std, +∞[a])	(0.216, +∞)	(0.277, 0.339)
Extremely high	(Mean + Std, +∞)	–	(0.339, +∞)

[a] Std means the standard deviation. The statistical standard for a High RTL grade is "(Mean + 0.5 Std, Mean + Std)".

grades; however, this tendency did not apply in cases with low initial RDL grades. This result shows that once the initial RDL has reached the intermediate-low grade, the intensification of rural transformation or RTL increases result in gradual improvements in rural development and URCL growth; that is, they promoting urban–rural coordination development. However, this law is not obvious in units with low initial RDL grades because different regions with a low initial RDL usually adopt development approaches uniquely suited to their respective physical and socio-economic conditions, which lead to different transformation development results, as shown in the above analysis of RTD territorial types.

The regions with a high initial RDL showed different urban–rural development patterns due to their universally low RTL and high RDL. From 2000 to 2008, a clear RDL increase occurred in the high and extremely high grade initial RDLs and RTLs, due to their adequate resources for agricultural and rural development; however, the URCL continued to grow negatively because regional RTD could not keep up with rapid industrialization and urbanization.

A case study of Suzhou city

Suzhou City is situated on the lower reaches of the Yangtze River in southern Jiangsu Province (known as *Sunan*), one of the fastest-growing regions in China. It covers about 848,800 ha and has an average elevation of less than 10 m. The northern subtropical monsoon climate dominates this region year-round, with an average annual temperature of 17.0° Celsius, and a mean annual rainfall of 1000 mm, which is beneficial for agricultural production. Suzhou had a population of 6.30 million in 2008 (SSB, 2009). In 2008, the per capita GDP of Suzhou was 106,863 RMB¥ (In 2008, the exchange rate for US$ to RMB¥ was 1:6.8), which was much higher than the national per capita GDP for China (23,708 RMB¥) during the same period (NBSC, 2009; SSB, 2009). In 2008, the primary industry only provided 1.6% of the total GDP in Suzhou; however, 62.0% and 36.4% were provided by the secondary industry and tertiary industry, respectively (SSB, 2009).

Three different phases of RTD can be observed in Suzhou after the reform and open-door policy was initiated. In the first phase (1978–1995), the regional economy was mainly boosted by the TVE boom in rural areas. This model of rural industrialization development is widely known as the "Sunan Model".[4] In the second phase (1995–2000), the majority of the TVEs in Suzhou had experienced a tough transformation from collective ownership to a shareholding system or private ownership (Hong & Chen, 2001; Shen & Ma, 2005). Thus, the whole region experienced a short-term period of economic stagnation (Shen & Ma, 2005; Zhao & Wong, 2002). In the third phase (2000-present), the positive effect of TVE transformation emerged gradually, with private enterprises and foreign investment enterprises injecting new vitality into rural industries. This latest incarnation of the development model is known as the "New Sunan Model" (Hong & Chen, 2001; Li, Long, & Liu, 2010).

Figs. 3 and 8 show that Suzhou belongs to RTD Type IX; that is, TVEs dominated this development type. From 1995 to 2000, there was a temporary embarrassment caused by TVE transformation in Suzhou. TVEs began to lose their competitiveness and economic vitality in the early 1990s, when several negative factors converged, including the increasing marketization of the economy, increasing local tax obligations, strict limitations on bank loans to reduce bad debts, and TVEs' ambiguous property rights. Kept afloat by bank loans arranged by the local government, loss-making firms continued to produce, which adversely affected the local economy (Shen & Ma, 2005). Meanwhile, the rising urban and rural incomes greatly increased the demand for better-quality consumer goods, which the TVEs were unable to provide. The TVEs' transformation in Suzhou since 1996 has mainly focused on reforming the TVEs' property rights arrangements, including the adoption of a share-holding cooperative system and privatization, with privatization preferred by the local government and private entrepreneurs (Li & Rozelle, 2003). Most of the TVE transformation was completed by 1999. Most enterprises were quickly taken over by individuals or partner groups, and many of them were restructured as share-holding corporations or shareholding cooperative enterprises (Shen & Ma, 2005). Because transformation costs reduce private firms' efficiency in the year they become privatized (Li & Rozelle, 2000), the growth rate of TVEs during that period was much slower than in previous periods (Zhao & Wong, 2002).

Since 2000, the private enterprises of Suzhou have entered a new phase of rapid development, and the city has taken on a new round of industrial development, which is regarded as the "New Sunan Model". Although transitional costs reduced efficiency while firms were being privatized, there is usually a net positive gain to privatization in the subsequent years (Li & Rozelle, 2000). It was widely agreed that the transformation improved the quality of the enterprises' operation, and restructured enterprises maintained more stable, faster growth (Shen & Ma, 2005). From 2000 to 2008, Suzhou made a comprehensive breakthrough in rural economic and social development, as evidenced by the decline of the Engel coefficient for rural residents (by 11.62%), the proportion of the output value of primary industry in the total GDP (by 72.49%) and the proportion of workers employed in farming, forestry, animal husbandry and fishery industries relative to the total number of workers (by 70.42%). In addition, economic globalization and rapid urbanization accelerated the expansion and upgrade of the demand and consumption of agricultural products and services. In response, the local government began to encourage farmers to change their planting patterns through favorable policies, which included providing subsidies and high-quality seeds for farmers and providing credit guarantees and tax relief for local major agricultural enterprises. However, these policies have not had a large effect on regional agricultural development in Suzhou, as

[4] The term "Sunan model" was originally coined by the eminent sociologist Fei Xiaotong to refer to the rapid development of the regional economy in southern Jiangsu (*Sunan*) based on the massive surge of collectively owned TVEs that prospered from the 1980s to the early 1990s (Fei, 1996).

Table 6
The statistical features of China's RTD.

Initial RDL grade	RTL grade	Average ΔRDL	Average ΔURCL	Proportion of URCL growth units in the total units of the same grade	Total units of the same grade
Low	Low	0.118	0.009	44.1%	34
	Intermediate-low	0.119	0.005	56.1%	41
	Intermediate-high	0.116	0.001	46.2%	26
	High	0.120	0.028	59.1%	22
Intermediate-low	Low	0.154	−0.052	28.6%	14
	Intermediate-low	0.133	−0.030	37.0%	27
	Intermediate-high	0.138	0.027	72.7%	11
	High	0.154	0.061	70.0%	10
Intermediate-high	Low	0.117	−0.019	44.4%	18
	Intermediate-low	0.118	−0.018	31.3%	16
	Intermediate-high	0.129	−0.011	55.6%	9
	High	0.131	0.027	68.8%	16
High	Low	0.125	−0.086	11.8%	17
	Intermediate-low	0.132	−0.086	14.3%	14
	Intermediate-high	0.144	−0.063	20.8%	24
	High	0.167	−0.018	27.8%	18
	Extremely high	0.207	−0.010	36.7%	30

evidenced by the decline of the proportion of crop area to total farmland (by 26.91%). Therefore, with rapid economic development, Suzhou had an obvious growth in its RDL ($\Delta RDL = 0.2668$) from 0.3709 in 2000 to 0.6377 in 2008 (Figs. 3–5). From 2000 to 2008, the high RTL (0.4406) in Suzhou promoted rural development to a great extent, but rapid industrialization and urbanization led to a reduction in URCL ($\Delta URCL = -0.0822$).

Discussion and conclusions

This study establishes indicator systems for three dimensions used to measure China's *rural transformation development* (RTD): the *rural development level* (RDL), the *rural transformation level* (RTL), and the *urban–rural coordination level* (URCL). The spatiotemporal characteristics of China's RTD from 2000 to 2008 were analyzed in relation to these three indicators. Our results show that China's regional rural system of China has universally experienced an intensive transformation since 2000. A systematic review of RTD for the entire country, and the case of Suzhou, show how the established indicator systems for measuring RTD play an important role in analyzing the spatiotemporal characteristics and internal mechanisms of China's RTD. This analysis helps to determine how the development status and regional characteristics of an area can lead to substantial improvement in rural residents' well-being in the early 21st century.

Constrained by physical conditions and general socioeconomic development patterns, China's RDL in 2000 showed a gradient, declining spatial pattern from east to west. With the rapid development of China's economy from 2000 to 2008, regional RDL at a national level generally shows a clear increase, with different rates of development resulting from different regional development models and policies. In general, due to these different regional development models, China's RTL from 2000 to 2008 took on a complex spatial pattern, which caused a dynamic spatial pattern for regional URCL during the same period without an obvious spatial pattern. In general, China's urban–rural coordination development declined between 2000 and 2008. The regions that experienced a reduction in URCL were mainly concentrated in areas with rapid economic development but without a good balance between urban and rural areas.

By analyzing the territorial types and mathematical statistical features of China's RTD, the internal mechanism of regional RTD was identified. The results show that low initial RDL, together with defective or excessive RTL inevitably leads to uncoordinated urban–rural development. In the regions with certain initial RDL grades, advancing RTD will effectively coordinate development between the urban and rural areas. Appropriate RTD that corresponds to certain RDLs will lead to the effective development of the regional rural system and the improvement of urban–rural relationships. In the regions with high initial RDL grades, more powerful measures should be taken to advance regional RTD to ensure a coordinated urban–rural development pattern; otherwise, the URCL will continue a negative growth trend as the pace of regional RTD falls drastically behind the pace of rapid industrialization and urbanization.

Currently, both rural development and urban development in China are experiencing a transition period. RTD in China was mainly characterized by accelerated rural industrialization and urbanization processes, which have greatly changed the rural areas, for instance, with the loss of cultivated land to factory workshops and the transformation of rural laborers to industrial workers. These changes have resulted in a radical transformation of the rural industrial structure, employment structure and land-use pattern. Since the turn of the century, narrowing the prosperity gap between urban and rural areas and achieving urban–rural coordination development have been central concerns of China's central government. However, the urban–rural coordination development status in China has not improved. Rather, it has continuously deteriorated as a result of rapid industrialization and urbanization processes since the beginning of the 21st century, especially in eastern coastal China. More powerful measures to fuel RTD, such as strengthening financial and technological support from industry and urban areas to agriculture and rural areas, are needed to reverse the trend of agricultural deprivation. In the future, more attention should be focused on improving the RDL and individual competitiveness. This attention will ensure that urban–rural coordination development can be achieved within the context of pressure from rapid industrialization and urbanization in the new century. In China, interregional inequality has been rising, most notably between the more highly developed eastern region and the lagging central and western regions (Li & Wei, 2010). This regional inequality is demonstrated by the RTD, as shown in Fig. 8. Given the multiscale nature of regional inequalities, as measured by RTD, rural development policies aimed at various and specific RTD types might be the most effective way to improve urban–rural coordination development. The layout and implementation of these policies will enable the restructuring of rural industry and aid rural development, which

may finally shape a more equitable urban–rural coordination development pattern in China.

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References

Ahmed, M. U. (1993). Development of rural industries and transformation of China's rural economy. *Asia-Pacific Journal of Rural Development, 3*, 1–19.
Ali, A. M. S. (2007). Population pressure, agricultural intensification and changes in rural systems in Bangladesh. *Geoforum, 38*, 720–738.
Cai, Y. L. (1999). Geographical study on sustainable agriculture and rural development. *Advance in Earth Sciences, 14*, 602–606, (in Chinese).
Cai, Y. L. (2001). The mechanisms of cropland conservation in Chinese rural transformation. *Scientia Geographica Sinica, 21*, 1–6, (in Chinese).
Cai, Y. L., & Smit, B. (1994). Sustainability in Chinese agriculture: challenge and hope. *Agriculture, Ecosystems & Environment, 49*, 279–288.
Capo, E. (1995). Transformation and development in Italian rural society. *Sociologia Ruralis, 35*, 297–308.
Cloke, P. (1977). An index of rurality for England and Wales. *Regional Studies, 11*, 31–46.
Cloke, P. (1994). Enculturing political economy: a life in the day of a 'rural geographer'. In P. Cloke, M. Doel, D. Matless, M. Phillips, & N. Thrift (Eds.), *Writing the Rural. Five Cultural Geographies*. London: Paul Chapman Publishing.
Cloke, P., & Edwards, G. (1986). Rurality in England and Wales 1981: a replication of the 1971 index. *Regional Studies, 20*, 289–306.
Cloke, P., Goodwin, M., & Milbourne, P. (1997). *Rural Wales: community and marginalization*. Cardiff: University of Wales Press.
Dandekar, M. N. (1988). Transformation in agriculture and rural development. *Journal of Rural Development (Hyderabad), 7*, 541–559.
Fei, X. T. (1996). Small town, big issue. In X. T. Fei (Ed.), *Love my hometown*. Beijing: Qunyan Press.
Gibson, K., Cahill, A., & McKay, D. (2010). Rethinking the dynamics of rural transformation: performing different development pathways in a Philippine municipality. *Transactions of the Institute of British Geographers, 35*, 237–255.
Goodman, D. S. G. (2008). *China's regional development* (5th ed.). London: Royal Institute of International Affairs.
Hara, Y., Takeuchi, K., & Okubo, S. (2005). Urbanization linked with past agricultural land use patterns in the urban fringe of a deltaic Asian mega-city: a case study in Bangkok. *Landscape and Urban Planning, 73*, 16–28.
Hong, Y. X., & Chen, B. M. (2001). New development of "Sunan model". *Macroeconomics, 7*, 29–34, 52, (In Chinese).
Kamusoko, C., Aniya, M., Adi, B., & Manjoro, M. (2009). Rural sustainability under threat in Zimbabwe – Simulation of future land use/cover changes in the Bindura district based on the Markov-cellular automata model. *Applied Geography, 29*, 435–447.
Kassioumis, K., Papageorgiou, K., Christodoulou, A., Blioumis, V., Stamou, N., & Karameris, A. (2004). Rural development by afforestation in predominantly agricultural areas: issues and challenges from two areas in Greece. *Forest Policy and Economics, 6*, 483–496.
Kennedy, J. J., Thomas, J. W., & Glueck, P. (2001). Evolving forestry and rural development beliefs at midpoint and close of the 20th century. *Forest Policy and Economics, 3*, 81–95.
Li, H. B., & Rozelle, S. (2000). Saving or stripping rural industry: an analysis of privatization and efficiency in China. *Agricultural Economics, 23*, 241–252.
Li, H. B., & Rozelle, S. (2003). Privatizing rural China: Insider privatization, innovative contracts and the performance of township enterprises. *China Quarterly, 176*, 981–1005.
Li, Y. R., & Wei, Y. H. D. (2010). The spatial-temporal hierarchy of regional inequality of China. *Applied Geography, 30*, 303–316.
Li, Y. R., Long, H. L., & Liu, Y. S. (2010). Industrial development and land use/cover change and their effects on local environment: a case study of Changshu in eastern coastal China. *Frontiers of Environmental Science & Engineering in China, 4*, 438–448.
Liu, Y. S. (2007). Rural transformation development and new countryside construction in eastern coastal area of China. *Acta Geographica Sinica, 62*, 563–570, (in Chinese).
Liu, Y. S., Wang, J. Y., & Long, H. L. (2010). Analysis of arable land loss and its impact on rural sustainability in southern Jiangsu Province of China. *Journal of Environmental Management, 91*, 646–653.
Liu, Y. S., Zhang, F. G., & Zhang, Y. W. (2009). Appraisal of typical rural development models during rapid urbanization in the eastern coastal region of China. *Journal of Geographical Sciences, 19*, 557–567.
Liu, Y. S., Zhang, Y. Y., & Guo, L. Y. (2010). Towards realistic assessment of cultivated land quality in an ecologically fragile environment: a satellite imagery-based approach. *Applied Geography, 30*, 271–281.
Long, H. L., Liu, Y. S., Li, X. B., & Chen, Y. F. (2010). Building new countryside in China: a geographical perspective. *Land Use Policy, 27*, 457–470.
Long, H. L., Liu, Y. S., Wu, X. Q., & Dong, G. H. (2009). Spatio-temporal dynamic patterns of farmland and rural settlements in Su-Xi-Chang region: implications for building a new countryside in coastal China. *Land Use Policy, 26*, 322–333.
Long, H. L., Zou, J., & Liu, Y. S. (2009). Differentiation of rural development driven by industrialization and urbanization in eastern coastal China. *Habitat International, 33*, 454–462.
Long, H. L., Heilig, G. K., Li, X. B., & Zhang, M. (2007). Socio-economic development and land-use change: analysis of rural housing land transition in the transect of the Yangtse River, China. *Land Use Policy, 24*, 141–153.
Long, H. L., Tang, G. P., Li, X. B., & Heilig, G. K. (2007). Socio-economic driving forces of land-use change in Kunshan, the Yangtze River delta economic area of China. *Journal of Environmental Management, 83*, 351–364.
López, S., & Sierra, R. (2010). Agricultural change in the Pastaza River basin: a spatially explicit model of native Amazonian cultivation. *Applied Geography, 30*, 355–369.
Mahon, M., Fahy, F., & Cinnéide, M. O. (2009). The significance of quality of life and sustainability at the urban–rural fringe in the making of place-based community. *GeoJournal*, doi:10.1007/s10708-009-9331-4.
Mann, S. (2009). Institutional causes of urban and rural sprawl in Switzerland. *Land Use Policy, 26*, 919–924.
McGee, T. G. (2008). Managing the rural–urban transformation in east Asia in the 21st century. *Sustainability Science, 3*, 155–167.
Muilu, T., & Rusanen, J. (2003). Rural young people in regional development – the case of Finland in 1970–2000. *Journal of Rural Studies, 19*, 295–307.
Müller, R., Müller, D., Schierhorn, F., & Gerold, G. (2011). Spatiotemporal modeling of the expansion of mechanized agriculture in the Bolivian lowland forests. *Applied Geography, 31*, 631–640.
Murdoch, J. (2000). Networks – a new paradigm of rural development? *Journal of Rural Studies, 16*, 407–419.
National Bureau of Statistics of China (NBSC). (2009). *China statistical yearbook*. Beijing: China Statistics Press.
Nelson, P. B. (2001). Rural restructuring in the American west: land use, family and class discourses. *Journal of Rural Studies, 17*, 395–407.
Nepal, R., & Thapa, G. B. (2009). Determinants of agricultural commercialization and mechanization in the hinterland of a city in Nepal. *Applied Geography, 29*, 377–389.
Putterman, L. (1997). On the past and future of China's township and village-owned enterprises. *World Development, 25*, 1639–1655.
Rizov, M. (2004). Rural development and welfare implications of CAP reforms. *Journal of Policy Modeling, 26*, 209–222.
Shen, X. P., & Ma, L. J. C. (2005). Privatization of rural industry and de facto urbanization from below in southern Jiangsu, China. *Geoforum, 36*, 761–777.
Sofer, M., & Applebaum, L. (2006). The rural space in Israel in search of renewed identity: the case of the moshav. *Journal of Rural Studies, 22*, 323–336.
Su, S. L., Jiang, Z. L., Zhang, Q., & Zhang, Y. (2011). Transformation of agricultural landscapes under rapid urbanization: a threat to sustainability in Hang-Jia-Hu region, China. *Applied Geography, 31*, 439–449.
Suzhou Statistical Bureau (SSB). (2009). *Suzhou statistical yearbook*. Beijing: China Statistics Press (in Chinese).
Terluin, I. J. (2003). Differences in economic development in rural regions of advanced countries: an overview and critical analysis of theories. *Journal of Rural Studies, 19*, 327–344.
Tilt, B. (2008). Smallholders and the 'household responsibility system': adapting to institutional change in Chinese agriculture. *Human Ecology, 36*, 189–199.
Unger, J. (2002). *The transformation of rural China*. Armonk: M.E. Sharpe.
Unger, J. (2006). Family customs and farmland reallocations in contemporary Chinese villages. *Social Transformations in Chinese Societies, 1*, 113–130.
Unger, J., & Chan, A. (1999). Inheritors of the boom: private enterprise and the role of local government in a rural south China township. *The China Journal, 42*, 45–74.
van der Ploeg, J. D., Renting, H., Brunori, G., Knickel, K., Mannion, J., Marsden, T., et al. (2000). Rural development: from practices and policies towards theory. *Sociologia Ruralis, 40*, 391–408.
Woods, M. (2011). *Rural*. Routledge: Abingdon and New York.
Xu, W., & Tan, K. C. (2002). Impact of reform and economic restructuring on rural systems in China: a case study of Yuhang, Zhejiang. *Journal of Rural Studies, 18*, 65–81.
Yu, W. H., Zang, S. Y., Wu, C. S., Liu, W., & Na, X. D. (2011). Analyzing and modeling land use land cover change (LUCC) in the Daqing city, China. *Applied Geography, 31*, 600–608.
Zhang, L. X., Rozelle, S., & Huang, J. K. (2001). Off-farm jobs and on-farm work in periods of boom and bust in rural China. *Journal of Comparative Economics, 29*, 505–526.
Zhao, S. X. B., & Wong, K. K. K. (2002). The sustainability dilemma of China's township and village enterprises: an analysis from spatial and functional perspectives. *Journal of Rural Studies, 18*, 257–273.