

Urbanization and sustainability in China: An analysis based on the urbanization Kuznets-curve

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Abstract

Nowadays, China's rapid urbanization is accompanied by emerging problems of nonsustainability, as a challenge to global sustainable development. Our research addresses the complicated relationship between urbanization and sustainability in China. First, we establish the Kuznets-curve hypothesis of urbanization and test its reliability based on evidence from China's urbanization, and the result shows that a win-win situation between urbanization and sustainability can possibly be achieved in China. Second, faced with an unbalanced urbanization trend in China that can be accommodated but not overturned, in order to realize the win-win situation effectively, the government needs to adopt a flexible urbanization strategy to combine an inclusive regional policy framework with a sustainable urban planning system in different regions of China.

Keywords

China, Kuznets-curve, sustainability, urbanization

Introduction

With half of the world population living in urban regions at the beginning of the 21st century, the urbanizing process has inevitably played an important role in human social

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development. In the so-called urbanized world, global sustainability cannot be achieved without sustainable urbanization being realized (UN-Habitat, 2002). Nowadays, the vast majority of developing countries are undergoing rapid urban growth, which results in about 5 million new urban inhabitants being absorbed monthly and is responsible for 95% of the world's urban population growth (UN-Habitat, 2008). In the future, with 5.3 billion urban inhabitants in developing countries by the middle of this century (UN-Habitat, 2008), the rapid urbanization of developing countries means not only enormous opportunities for human society but also serious challenges to global sustainable development (World Bank, 2006).

As the largest developing country, China is becoming one of the important engines of global urbanization, and is increasingly undergoing problems of nonsustainability. In 2009, there were 654 cities and 622 million urban inhabitants in China, with an urbanization rate of 46.59%; in the next 5 years, the urban population will exceed the rural population in China; by 2030, China's urbanization rate will reach 65%, and there will appear 300 million new urban inhabitants (IEAS, 2010). Many Chinese scholars think that China's rapid urbanization is aggravating the nonsustainable trends affecting the country (e.g. overconsumption of land resources or a/the shortage of freshwater) (Jin, 2006; Zhou, 2006) but others claim that it can release the potential of economic development and improve the efficiency of resource usage (Chen et al., 2009; Ding, 2005). Therefore, the following questions arise: What does rapid urbanization mean to sustainable development in China? Can a win-win situation be achieved between urbanization and sustainability in China? What are the directions for China's government to coordinate urbanization with sustainability?

Our research aims to answer these questions. First, we introduced the Kuznets-curve hypothesis of urbanization and tested its reliability for exploring the complicated relationship between urbanization and sustainability in China. Second, we focused on strategies for promoting China's sustainable urbanization. The research data were collected from the Chinese Urban Statistical Yearbooks (2001–2009). The structure of the article is as follows: section "Current state: rapid urbanization versus increasing nonsustainability" describes the current state of urbanization and sustainability in China, section "Complicated mechanism: the urbanization Kuznets-curve" establishes and tests the Kuznets-curve hypothesis of urbanization, section "A possible urbanization strategy: achieving a win-win situation in the unbalanced urbanizing process" discusses possible directions of government strategic response to China's urbanization, and section "Conclusion" contains some conclusions of this research.

Current state: rapid urbanization versus increasing nonsustainability

During the first decade of the 21st century, a new wave of urbanization has come into being in China, which is more complicated to understand and more difficult to control (Yeh et al., 2006). First, the urbanization rate of China ascended swiftly from 36.2% in 2000 to 45.7% in 2008, which means over 15 million new urban inhabitants appear in China yearly. Second, cities have played an important role in China's economic development. In 2008, the population of cities at the prefecture level and above accounted for

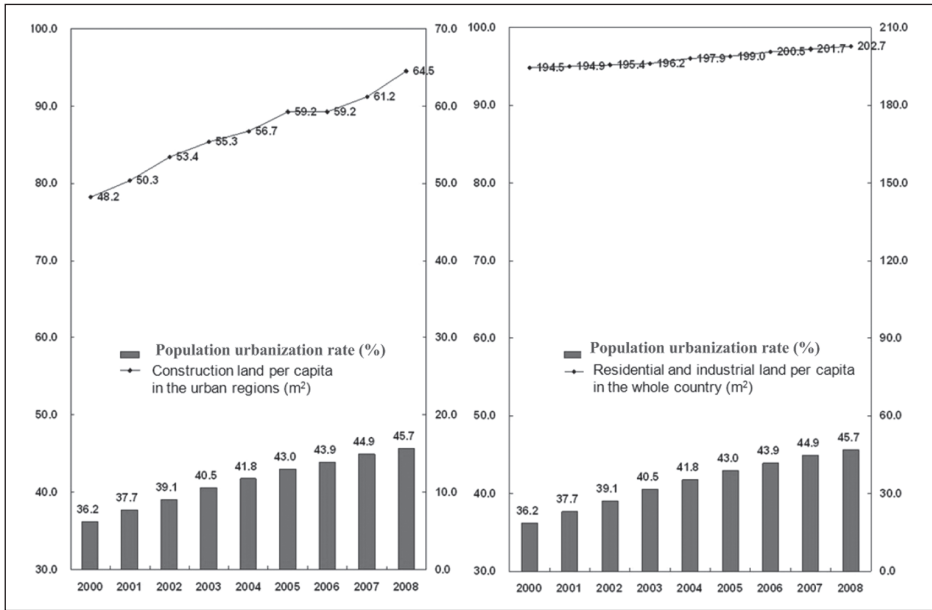


Figure 1. Urbanization rate and land consumption in China (2000–2008).

28.3% of the whole country’s population, but the gross product of these cities reached 62% of China’s gross domestic product (GDP). Moreover, sufficient evidence exists to show that the profound influence of China’s rapid urbanization has not only been multi-dimensional (social, economic, and ecological) but has also gone beyond the boundary of cities, crossed their peripheral regions, and almost reached remote areas.

To what extent has China’s rapid urbanization been connected with increasing problems of nonsustainability in these years? The concept of sustainability emerged because of natural resource issues; the primary sign of nonsustainability is overconsumption of natural resources. Therefore, we chose one key indicator (population urbanization rate) representing urbanization and two key indicators (area of construction land per capita in urban regions and area of residential and industrial land per capita in the whole country) representing nonsustainability, and collected relevant data in China from 2000 to 2008. We then examined the statistical correlation between urbanization and nonsustainability, in order to accurately describe the current state. The result shows that this rapid urbanization process has been related to increasingly serious overconsumption of land resources over this time (see Figure 1).

Figure 1 demonstrates that in terms of urban regions, the area of construction land per capita rose by 35.7% from 2000 to 2008, which is positively correlated with the rate of urbanization ($R^2 = 0.98$); at the level of the whole country, the area of residential and industrial land per capita increased by 4.2% from 2000 to 2008, which is also positively correlated with the urbanization rate ($R^2 = 0.95$). In particular, land resources are wasted more seriously in many urban regions. For example, there were 3837 urban development zones in 2003, most of which were not developed intensively; the planned land area of

these development zones reached up to 36,000 km², actually exceeding the total area of urban land currently under construction in China.

In summary, through description of current state as above, we can see that China's rapid urbanization has become increasingly unsustainable in these years. It is widely recognized that, on one hand, the shortage of natural resources has become a bottleneck in the development of urban areas, and, on the other hand, the fragility of urban environments has also reduced urban inhabitants' quality of life (Shao and Shi, 2007). Nevertheless, is China's rapid urbanization process destined to result in increasing non-sustainability in the long-term future? The question is too difficult to answer immediately because we cannot judge the long-term relationship between urbanization and sustainability in China based only on a simplistic description of the situation over the last few years. Therefore, in order to answer the question above, we ought to explore the complicated mechanism of urbanization and sustainability.

Complicated mechanism: the urbanization Kuznets-curve

In this section, based on the classic Kuznets-curve theory, we establish the hypothesis that the urbanization Kuznets-curve means a win-win situation may exist between urbanization and sustainability in the long term, and then test its reliability through evidence from China's urbanization.

The hypothesis of urbanization Kuznets-curve

As a well-known theoretical opinion, the environmental Kuznets-curve has come into being based on the classic Kuznets-curve theory. In 1950s, Kuznets (1955) hypothesized an inverted-U-shaped correlation existing between economic development and social inequality. In 1990s, some environmental economists were inspired from the classic theory of Kuznets-curve, and proposed the environmental Kuznets-curve hypothesis that means the inverted-U-shaped correlation also exists between economic development and environmental problems (Kenneth et al., 1995). This has been demonstrated by much empirical evidence, reflecting the relationship between economic outcomes and certain pollutants (Ekins, 1997; Grossman and Krueger, 1995; Selden and Song, 1994). The environmental Kuznets-curve suggests that during the whole period of economic development in a certain country or area, environmental quality may worsen at the initial stage, then keep steady at the middle stage, and finally, shift to a gradual improvement as a long-term trend. Up till now, although many scholars have criticized the limitations of the environmental Kuznets-curve (Egli and Steger, 2007; Khanna and Plassmann, 2004; Maddison, 2006), it still has a lasting influence on environmental policymaking around the world.

Borrowing the concept of the environmental Kuznets-curve, we can establish the urbanization Kuznets-curve as a new hypothesis. First, taking the environmental Kuznets-curve as a major premise, we can accept that the inverted-U-shaped correlation exists between economic development and environmental problems. Second, we can take two truisms as the minor premises: one is that economic development is the key driver of urbanization (and the phenomenon of urbanization results from economic development

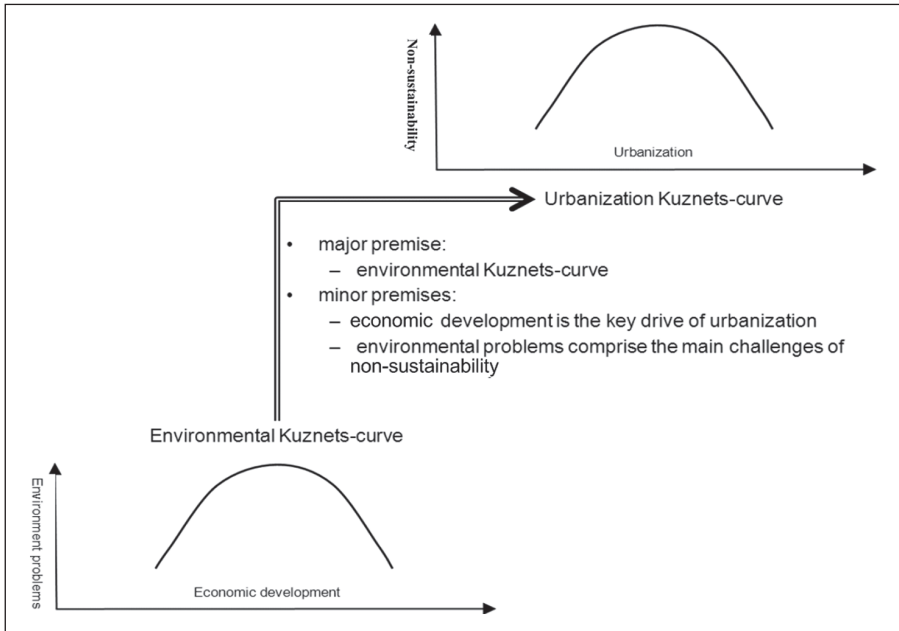


Figure 2. The urbanization Kuznets-curve deduced from the environmental Kuznets-curve.

essentially) and the other is that environmental problems bring about major challenges to sustainability (and the level of sustainability can be reflected by environment quality originally). Based on these premises, we can conclude that the urbanization Kuznets-curve hypothesis means an inverted-U-shaped correlation can exist between urbanization and nonsustainability during the whole period of economic development in certain country or area (see Figure 2): with the urbanization rate rising constantly as a result of economic development, the seriousness of loss of sustainability derived from environmental problems may be intensified in the initial stage falling as a long-term trend.

The hypothesis of this urbanization Kuznets-curve is helpful in understanding the complicated relationship between urbanization and sustainability. Given the hypothesis is reliable in China’s urbanizing process, it is recognized that the current contradiction between urbanization and sustainability in China may be attributed to the fact that China’s urbanization has stayed in the left part of Kuznets-curve until now, and then, we can speculate that China’s urbanization process will not permanently lead to increasing problems of nonsustainability in the future. In the next step, we need to test the reliability of the urbanization Kuznets-curve hypothesis in China through empirical research, before accepting the judgments mentioned earlier.

Reliability of the hypothesis in China

It is a very difficult task to test the reliability of the urbanization Kuznets-curve hypothesis in China. In spite of its rapid urbanization in the past decades, China is

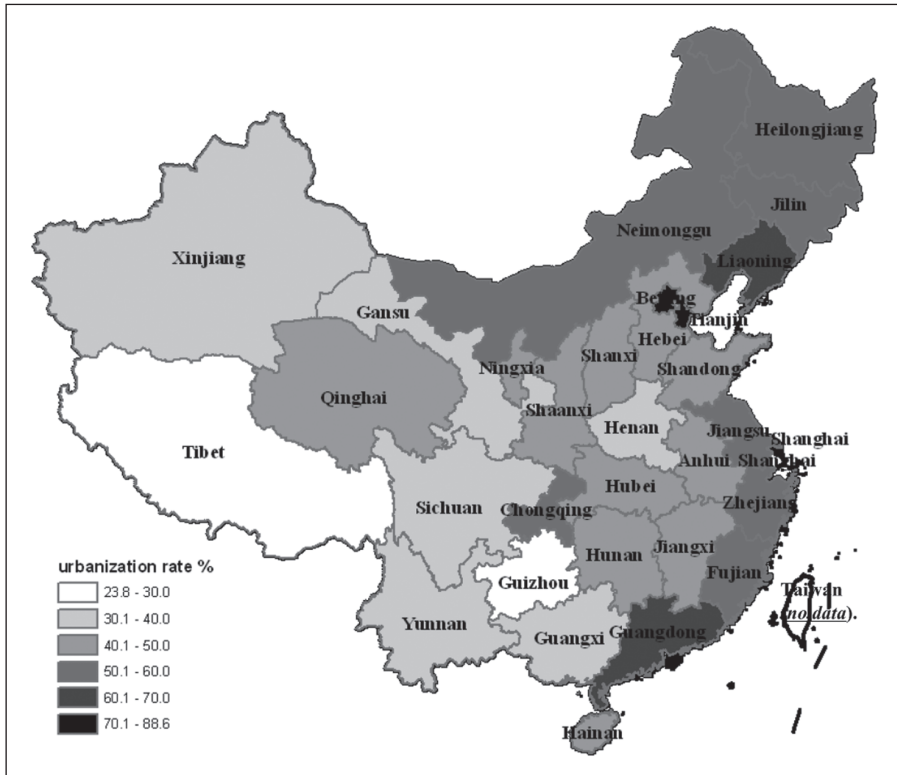


Figure 3. Urbanization rate of provinces in China (2008).

still in a lower urbanization level that may be considered a middle stage of urbanization. In fact, there is still a long way for China to reach the mature and steady stage of urbanization. Therefore, through the short-term experience of China's urbanization, we cannot directly test the hypothesis of the urbanization Kuznets-curve that depicts the long-term relationship between urbanization and sustainability.

Nevertheless, we are able to test the hypothesis indirectly considering several distinctive features in China's urbanization. The first is that urbanization rates among provinces of China are extremely different, varying from 23.8% (Tibet) to 88.6% (Shanghai) in 2008 (see Figure 3), which means that the urbanization of some coastal provinces is already in the right side of the Kuznets-curve. The other thing is that due to the great geographical differences in urbanization across China's vast territory, the inverted-U-shaped correlation between urbanization and sustainability can be found spatially across different provinces if the hypothesis of urbanization Kuznets-curve is reliable in China. Therefore, we are able to examine the reliability of the urbanization Kuznets-curve to a certain extent through province-level data of urbanization and sustainability in China.

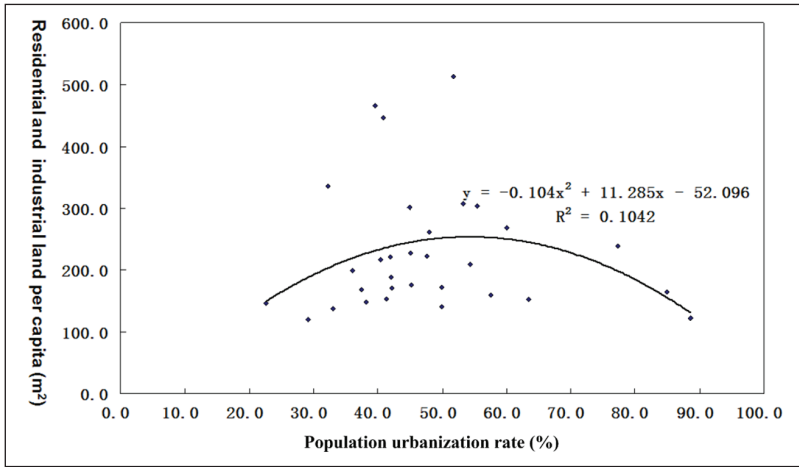


Figure 4. Urbanization rate and land consumption of provinces in China (2008).

In the empirical research, we collected province-level data relating to urbanization and sustainability in 2008 and analyzed their statistical correlation, to test the reliability of the hypothesis. The research work reveals that the relationship between urbanization and sustainability across different provinces of China reflects major characteristics of the Kuznets-curve evidentially. First, regarding land resource consumption, the negative quadratic curve is the fitting model of the relationship between the population urbanization rate and residential and industrial land area per capita, in accordance with the Kuznets-curve; it is apparent that the area of residential and industrial land per capita is going to reach the summit point when the population urbanization rate reaches the range from 50% to 60% (see Figure 4). Second, regarding environmental pollution, the negative quadratic curve is also the fitting model of the relationship between the population urbanization rate and industrial gaseous waste. Again, clearly in accordance with the Kuznets-curve, we can see that the gaseous waste volume per industrial production value tends to decline with the population urbanization rate increasing above 40% (see Figure 5).

In summary, the evidence of China's urbanization above confirms the reliability of the urbanization Kuznets-curve to a certain extent. This means that although the current rapid urbanization is confronted by the increasing problems of nonsustainability, the win-win situation between urbanization and sustainability may possibly come true in China. Considering the different regional urbanizing stages in China, urbanization means both a burden to some regions and an advantage to other regions in terms of pursuing sustainability. Thus, urbanization should be considered as a two-edged sword with regard to China's sustainability. More importantly, in order to avoid the old-fashioned development pattern of treatment after pollution, the government cannot passively wait and see the win-win situation emerging but push forward to move the relationship between urbanization and sustainability from contradiction to harmony through a comprehensive and proactive strategic response.

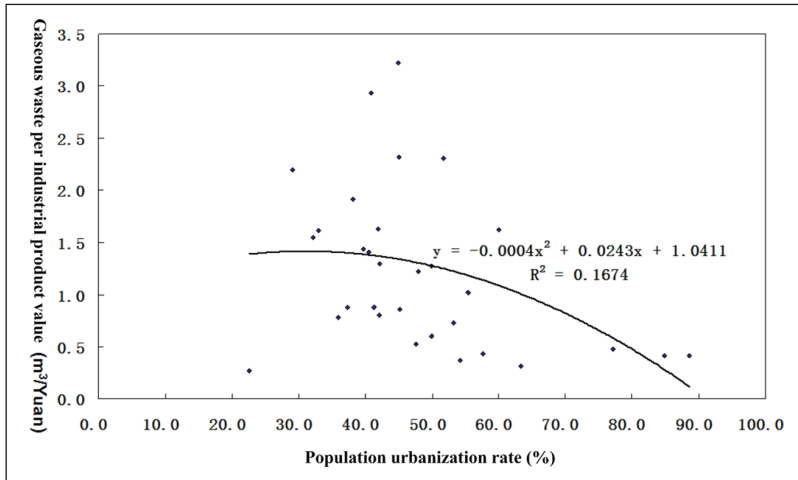


Figure 5. Urbanization rate and environment pollution of provinces in China (2008).

A possible urbanization strategy: achieving a win-win situation in the unbalanced urbanizing process

Faced with China's rapid urbanization and increasing nonsustainability, the government needs to implement a comprehensive strategic response. On one hand, due to the underlying impetus of economic development, the government has to recognize the unbalanced urbanizing process in China as a long-term trend that cannot be overturned but accommodated. On the other hand, in order to promote the relationship between urbanization and sustainability from contradiction to a win-win situation, the government needs to adopt a flexible urbanization strategy combining inclusive regional policy frameworks with sustainable urban planning systems in different regions of China.

The unbalanced urbanization as a long-term trend

The unbalanced process of urbanization in China will last as a long-term trend, due to the market mechanism of economic development. From the perspective of the new economic geography, the market mechanism of increasing returns of scale and positive feedback of agglomeration inevitably results in the unbalanced development of spatial economy (Fujita et al., 1999). In the globalizing world, the phenomenon of economic activities continually concentrating in specific locations has continued for a long time, and still exists in every country whatever its level of economic development (World Bank, 2008). Because economic development is the key driver of urbanization, and cities exist as substantial centers of economic growth, the development of economic activities can lead to inherently unbalanced urbanization. In China, during several decades of reform and opening up, a large number of labor forces and production activities have been concentrating in the coastal regions. Historically, the economic gap among different regions did not become convergent but has diverged (Liu et al., 2004); with industrial

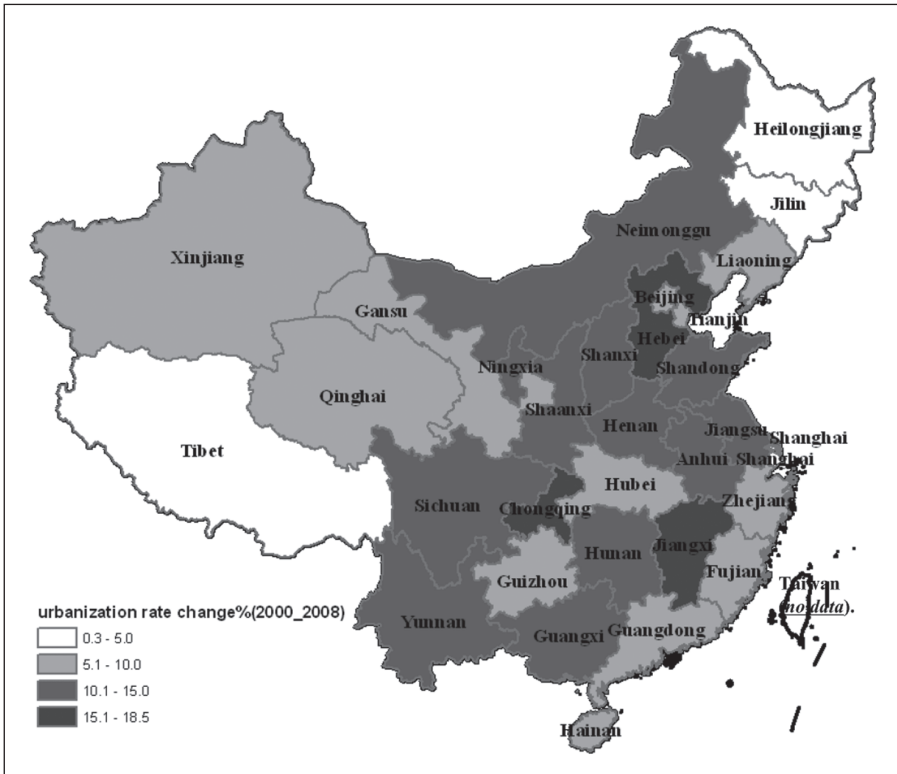


Figure 6. Urbanization rate change of provinces in China (2000–2008).

activities intensively concentrated within them, the industrial product of the coastal regions has accounted for an increasing proportion of the total amount in the whole country (Jin et al., 2006). With the floating/internal migrant population of China rising from 6 million in 1979 to 211 million in 2009, the total number of rural migrant workers who left home to work in cities has reached up to 150 million (IEAS, 2010). According to worldwide historical experiences, the trend of development will not slow down unless GDP per capita reaches the range from US\$10,000 to US\$15,000 (World Bank, 2008); as the GDP per capita of China was just US\$3735 in 2009, the process of development will not stop in the near future. With development of economic activities continuing to concentrate in coastal regions, the trend of unbalanced urbanization of China will last for a long time.

Despite their higher level of urbanization, China’s coastal regions will still exist as the main destination of economic activities and labor force migration, and the major container of the new urban population. From 2000 to 2008, the urbanization rates of coastal regions increased quite significantly (see Figure 6). Up to now, all the three major urban agglomerations of China have been situated in coastal regions, including the Yangtze River Delta, the Pearl River Delta, and the Bohai Bay Area. For example, the Yangtze River Delta has

an area of 210,700 km², only accounting for 2.2% of the total land area of China; yet, in 2009, its population was 148 million, reaching 11.1% of the total population of China, and its gross product was 7179 billion yuan, contributing 21.4% of China's GDP. Although the government may pursue the goals of spatial balance in the unbalanced urbanizing process, plenty of evidence similar to that mentioned above demonstrates that economic development is imperative for country development and spatial imbalance is inevitable in the urbanizing process. Consequently, any irrational attempt to relocate economic activities artificially or to adjust the urbanizing process arbitrarily would probably create obstacles to (hinder) economic growth and urban development, which may fail in pursuing the goal of absolutely balanced development at the high cost of losing economic efficiency. Consequently, we have to acknowledge the fact that the unbalanced urbanization process cannot be overturned easily but must be accommodated thoughtfully in China.

Even with this unbalanced urbanizing process, it is still possible to realize sustainable development in China. Besides its advantage of economic efficiency, the unbalanced urbanizing process can bring about potential opportunities for environmental protection and social equity. On one hand, the unbalanced urbanizing process can help to reduce the pressure of urbanization on the environment. There is not much land suitable for human settlement development in China; it only accounts for 19% of the total land area. Moreover, most of the suitable land for urban development is located in the coastal regions of China. According to the urbanization Kuznets-curve hypothesis, many coastal regions have been in the right side of the Kuznets-curve so far, which means the pressure on the environment will be rather lighter as the urbanization rate is increasing faster in coastal regions than in other regions. Instead of restricting population migration within the midland or remote regions, encouraging population migration from midland or remote regions to coastal regions is more advisable because the new urban settlers can not only take advantage of economic development in coastal regions but also reduce the negative effects on the environment in midland or remote regions. On the other hand, the economic efficiency of unbalanced growth can also be in accordance with the goal of social equity. If the flows of labor and capital can move more fluidly across regions, the inhabitants of lagging regions will benefit more from rapid economic growth in the whole country. Consequently, the unbalanced growth of economic activities and growth of social equity can be brought together through rational policy arrangements for promoting sustainable urbanization (World Bank, 2008).

Inclusive regional policy and sustainable urban planning

Although it is possible to achieve sustainable development in China's unbalanced urbanizing process, the government must act to cope with the critical challenges of social inequity and environmental degradation. In China, the Gini coefficient of residents' income stepped up from 40.7 in 1993 to 47.3 in 2004, and nearly 95% of inhabitants below the poverty line lived in environmentally fragile areas in 2005 (United Nations Development Programme (UNDP), 2010). For the Chinese government, the key task is to guarantee both social equity and environmental quality in the unbalanced urbanizing process.

In this section, we suggest that the government should adopt a flexible strategy to combine inclusive regional policy frameworks with sustainable urban planning systems

in different regions of China. On one hand, in order to promote both development and equity together, the government should facilitate economic development, migration, and specialization in the unbalanced urbanizing world through the inclusive policy framework that combines various kinds of instruments as follows (World Bank, 2008): institutions that contain policies applied generally in the whole country and not focusing on specific locations (e.g. health and education policies), infrastructure that focuses on connections between adjacent locations (e.g. improvement of roads and airports), and incentives that include local intervention limited in specific places (e.g. supplementing affordable housing). On the other hand, a sustainable urban planning system is essential to deal with the new challenges to local cities such as global climate change, economic instability, and uncontrolled urban sprawl (UN-Habitat, 2009). Due to the complexity of problems with sustainability and differences between urbanizing regions in China, it is advisable for the government to combine the inclusive regional policy framework with sustainable urban planning systems specific to different urbanizing regions for achieving the win-win situation (see Table 1).

In remote regions of China, which are lagging in economic development and lacking the impetus to urbanization, policy issues should primarily focus on fiscal transfers to local government and basic public service supplements, and avoid compelling urbanization excessively through arbitrary spatial interventions. Because of social, historical, or location disadvantages, the critical dilemma of remote regions is that they are deficient in terms of the industrial impetus to urbanization. Given that the government allocates its scarce financial revenue to large-scale regional infrastructure construction or to specific local incentives on place marketing, it may not only result in an overloaded burden on public investment but also fail to realize effective urbanization. Therefore, on one hand, the fiscal transfers to local government is a necessity for these remote regions; on the other hand, regional governments ought to focus on improving the people's quality of life through supplementing basic public services (e.g. education, security, healthy), especially in rural areas. The ecological system and environmental quality should be protected through migration for reducing ecological stress, village reconditioning, and so on. The labor quality of the rural population needs to be improved through increasing investment in compulsory education and professional skill training programs. Accordingly, local city planners' primary objective is to guarantee basic public services for every inhabitant equally while urban planning should focus on the arrangement and design of necessary public projects (hospitals, schools, etc.).

In the midland regions of China, which face both the boost of industrial growth and a relatively low urbanization rate, policy issues should pay attention to improving regional transport infrastructure, besides the institution of basic public services. Faced with a widening urban-rural gap and the increasing demand of regional communication, regional governments should continue to focus on public institutions for strengthening urban-rural unity, reducing the income disparity between urban and rural areas, and accommodating the urban-rural migration spurred by economic development. Meanwhile, in order to overcome the space-time distance and to reduce the transportation costs of economic activities in order to boost the industrial growth process, the government ought to invest in key regional transport infrastructure (e.g. expressways, railroads, and airports), which are essential to eliminate urban-rural exchange hindrances

Table 1. Directions of urbanization strategy in different regions.

Regions	Key problems	Inclusive regional policy			Sustainable urban planning	
		Institutions	Infrastructures	Incentives	Primary objective	Basic assignments
Remote regions Lagging in economic development Lacking of urbanizing impetus	Critical dilemma (scarcity of urbanizing impetus because of historical, environmental, or location causes)	•	◦	□	To guarantee basic public services	Arrangement and design of public projects (hospital, school etc.)
Midland regions Boosting industrialization Relative low rate of urbanization	Dual challenges (widening urban-rural gap; increasing demand of regional communication)	□	□	◦	To strengthen the regional integration	Strengthening multicenter region; constructing transport network
Coastal regions Competition of globalizing economy Accelerating speed of urbanization	Multiple contradictions (urban sprawl, ecological degradation, and social polarization)	□	□	□	To manage rapid growth	Smart growth; urban redevelopment;

•: most important; □: important; ◦: not important.

and to accelerate the mobility of commodities and services across locations. Accordingly, local city planners' primary objective should be to enhance regional integration. Moreover, urban planning should focus on strengthening multicenter regions, and constructing regional transport networks.

In coastal regions of China, which are confronted with multiple predicaments of urban sprawl, ecological destruction, and social polarization resulting from accelerating urbanization and globalizing competition, policy development should emphasize specific local incentives in order to deal with emerging problematic places, besides focusing on institutions and infrastructure. The uncontrolled expansion of many coastal urban regions has led to the enormous disturbances to regional ecosystems; therefore, the government must improve the environmental performance of spatial development and protect the ecological sensitive sites. On the contrary, faced with global inter-city competition, many coastal metropolises have been involved in the unprecedented process of economic transition and spatial reconstruction, but this has meant new urban poverty (including low-income migration, disadvantaged habitats, etc.) is emerging substantially and concentrating in derelict places, which results in unending social conflict. For this reason, the government must focus on specific local incentives for affordable housing construction, local employment promotion, and so on, in order to share the fruits of economic growth and urbanization equally among different local communities. Accordingly, local city planners' primary objective is to manage rapid growth. Moreover, urban planning should focus on smart growth and urban redevelopment.

Conclusion

Despite the current rapid urbanization and its increasing nonsustainability in China, our research shows that it is still possible to achieve a win-win situation between urbanization and sustainability, based on the hypothesis of the urbanization Kuznets-curve. Due to China's unbalanced urbanizing process being a long-term trend that cannot be overturned but must be accommodated in the future, the key issue is to share the fruits of economic development and population urbanization across different urbanizing regions and among all social groups equally; the practical way is to accept the unbalanced growth geographically and encourage the equal development of people. Therefore, it is recommended that the government flexibly combine inclusive regional policy frameworks with sustainable urban planning systems in different regions in order to resolve the current contradiction and to effectively promote a win-win situation between urbanization and sustainability. The Chinese government should especially pay more attention to the institution of basic public services, including education, healthy, security, and so on, besides the geographical instruments of regional infrastructure and local incentives. Finally, these opinions about China's urbanization and sustainability in this article may also be applicable to some other developing countries that are faced with similar challenges of rapid urbanization while pursuing sustainable urbanization.

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