

# The provincial pattern of the relationship between urbanization and economic development in China

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**Abstract:** Understanding the relationship between China's urbanization and economic development on a provincial scale is of profound theoretical and practical significance. Based on data from 124 countries or regions throughout the world and 31 provinces or autonomous regions in China, applying improved methods using the quadrant map approach, this paper analyzed the spatial pattern of the relationship between China's urbanization and economic development level. The study identified the following results. (1) The 31 province-level regions fall into six categories: only one region is in the category of sharp over-urbanization, 3 regions are in medium over-urbanization, 11 slight over-urbanization, 8 basic coordination, one medium under-urbanization, and seven slight under-urbanization. (2) There are significant regional differences on a provincial scale in the relationships between urbanization and the level of economic development. (3) The provincial pattern of urbanization and economic development is significantly different between east and west. The eastern coastal areas are mainly over-urbanized, while the central and western regions are mainly under-urbanized. (4) The relationship between urbanization and the level of economic development is similar to the Matthew effect. Hence, two important insights are proposed. First, the phenomenon of over-urbanization in some developed regions should be viewed with some concern and vigilance. Second, urbanization needs to be speeded up moderately in the central and western regions.

**Keywords:** urbanization; economic development; relationship; provincial pattern; China

## 1 Introduction

The relationship between urbanization and the level of economic development in terms of geography, economics and demography is a classic topic of discussion. Chenery and Syrquin (1988) systematically analyzed the relationship patterns between urbanization and economic development level in the 1970s, and Chinese scholar proposed the logarithm regression

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model for urbanization and per capita GDP (Zhou, 1982). In general, there is a strong correlation between urbanization and the level of economic development, and it seems that each country or region conforms to this rule to a certain degree (Henderson, 2003; Liang, 1999). This has become a fruitful empirical research domain, which implies the complexity of this relationship. Urbanization in China is not like the parallel urbanization of Western countries, nor like the over-urbanization in many developing countries, which falls into the categories of under-urbanization that urbanization lags behind economic development level (Zhang and Zhao, 2003; Ebanks and Cheng, 1990; Liu *et al.*, 2003). While some research has pointed out that urbanization did not lag behind the level of economic development before 1978, it has become more prevalent than under-urbanization with the surges in rural–urban immigration that have occurred in the mid and later periods of the Reform and Opening-up Policy (Chang and Brada, 2006). Furthermore, some scholars hold the view that the urbanization of China is increasing dramatically, at breakneck speed (Friedmann, 2006), and that it displays the characteristics of the rapid growth of urban scale and peri-urbanization (Lin, 2006; Lin, 2007; Chen *et al.*, 2013).

There are many divergent views on this relationship among domestic scholars. Lu holds that aggressive and rash urbanizing in China will trigger many serious development problems (Lu *et al.*, 2007), while Guo believes that urbanization lags behind the economic development level (Guo, 2002). Gu investigated the relationship between urbanization and the level of socio-economic development in the case of Jiangsu and Zhejiang provinces, and the results suggest a reciprocal dependency and supporting relationship between urbanization and the socio-economic development level (Gu, 2004). Fang and Liu (2007) suggested that urbanization has already entered a stage of rapid growth and that the phenomenon of regional deprivation has been increasing even faster. In general, most scholars hold the view that urbanization lags behind economic development. Meanwhile, given the wide variation between China's different regions, many scholars have devoted much effort into studying the regional diversity of urbanization (Xu and Ye, 1986; Zhang, 2002; Zhu *et al.*, 2006; Liu, 2007; Gu *et al.*, 2008) and the spatial pattern of the relationship between urbanization and the economic development level (Fan and Tian, 2003; Liu *et al.*, 2003; Li, 2008). With regard to the recognition of this relationship, quantitative parameters deriving from data from the 1950s to the 1970s by Chenery are no longer appropriate in the new contextualization, so there is a need to reinvestigate the relationship between urbanization and economic development. Moreover, much effort has been devoted to studying the regional diversity of this relationship from a macro perspective, and less attention has been given to studying the degree and type of diversity.

As a number of development goals have been proposed, such as promoting healthy urbanization and transforming the economic development pattern, the central government of China is paying a great deal of attention to changing its development strategy. Thus, exploring the relationship between urbanization and economic development would be of great theoretical and practical significance in this context. This paper, focusing on the provincial scale, explores the spatial pattern of the relationship between urbanization and economic development in China, and compares the urbanization of China's provincial regions with countries and regions around the world, in order to make a number of recommendations and solutions for healthy urbanization in China.

## 2 Method and data

### 2.1 Method

The method used to recognize and explore the relationship between urbanization and economic development was mainly based on time-series data, such as the ratio of urbanization and per capita GDP or the proportion of non-agricultural industry. This method allows an understanding to be gained of the synergism between urbanization and economic development, but has some limits in investigating the evolvement, diversity and the incompatibility of a nonlinearity model for the relationship. Chen *et al.* (2009) proposed the quadrant scatter method for investigating the relationship between urbanization and economic development. The present study has revised the quadrant scatter method by incorporating the degree of deviation in order to investigate the provincial pattern of the relationship between urbanization and economic development.

The revised quadrant scatter method proceeds as follows:

- 1) Prepare the data on per capita GDP (GDPP) and urbanization (URBAN) for countries around the world.
- 2) Standardize GDPP and URBAN and generate new variables, named ZGDPP and ZURBAN, with the standardization process being conducted using the equation:

$$z = (x_i - \bar{x}) / s$$

where  $i$  is the observed data;  $\bar{x}$  is the average value of  $x_i$ ,  $\bar{x} = \sum x / n$ ;  $s$  is the standard deviation,  $s = \sqrt{\sum (x_i - \bar{x})^2 / (n - 1)}$ .

- 3) Define ZGDPP as the X axis and ZURBAN as the Y axis. Generate a point set for the per capita GDP and urbanization of each country (ZGDPP, ZURBAN), and the quadrant scatter would be generated on this point set.

The recognition principles of the relationship are as follows:

Principle 1: The sign of ZGDPP–ZURBAN. ZGDPP represents the deviated degree of each GDPP from its origin, and ZURBAN represents the deviated degree of urbanization from its origin. ZGDPP–ZURBAN means the relationship between the degree of deviation of urbanization and per capita GDP. When ZGDPP–ZURBAN < 0, the point would fall into area 1 (Figure 1), which indicates the over-urbanization pattern. When ZGDPP–ZURBAN > 0, the point would fall into area 2, which means the under-urbanization pattern. When ZGDPP equals ZURBAN – that is, ZGDPP–ZURBAN = 0 – and when the point falls on the straight line going through the coordinate origin and the slope value is 1, this indicates basic coordination between urbanization and economic development, which is in line with most countries in the world.

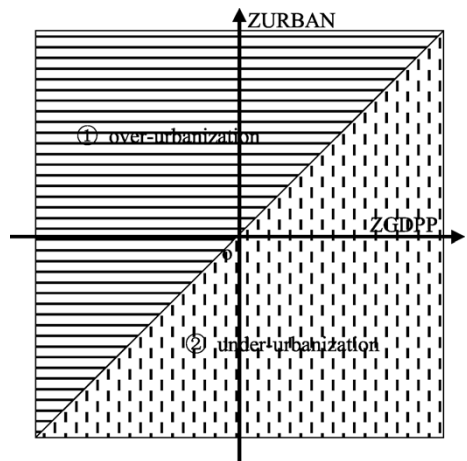


Figure 1 The classification of urbanization and economic development

Principle 2: The difference value of ZGDPP–ZURBAN. When  $0 \leq |ZGDPP - ZURBAN| \leq 0.1$ , the relationship would be a pattern of basic coordination. When  $0.1 < |ZGDPP - ZURBAN| \leq 0.5$ , the relationship would be a slight deviation pattern. When  $0.5 < |ZGDPP - ZURBAN| \leq 1$ , the relationship would be a medium deviation pattern. When  $|ZGDPP - ZURBAN| > 1$ , the relationship would be a high deviation pattern.

Based on the revised quadrant scatter method and recognition principles, the various relationships between urbanization and economic development can be divided into seven patterns: sharp over-urbanization, medium over-urbanization, slight over-urbanization, basic coordination, sharp under-urbanization, medium under-urbanization and slight under-urbanization.

## 2.2 Data sources

Urbanization (URBAN) was calculated by considering the urban population as a proportion of the gross population, and economic development was represented by the index of per capita GDP (GDPP). The country data were originated by the World Bank, with 226 countries and regions being sampled, and 124 of these forming the applied world data. Provincial data for China were derived from the China Statistical Yearbook 2007, and owing to some missing data this study did not include Hong Kong, Macau and Taiwan. The final data of 155 cases were then combined with the international and Chinese provincial data. One fact that needs to be clarified is that although many scholars have revised official Chinese urban population data to calculate the urbanization level (Zhou and Ma, 2003; Zhang and Zhao, 1998), less agreement has been drawn. Taking the authority and comparability of data into consideration, official data were used in the present study.

With regard to the comparability of data and scale, three factors should be clarified. First, this study takes cross-section data for 2011. Second, GDP per capita is a comprehensive index that is widely used by the UN and World Bank to represent each country's economic development level. It is a multi-dimensional index that can reflect the structure of industry and salary income. Third, the present study does not take into account the impact of the national territory area on the relationship between urbanization and economic development. Making comparisons with many countries in the world helps to reveal the type of diversity pattern, and thus to make suggestions for sustainable regional development.

## 3 Provincial patterns of urbanization and economic development level

### 3.1 Provincial patterns of urbanization

Following 30 years of reform and opening-up, the level of urbanization has been greatly increased, with a ratio of 51.27% in the country as a whole in 2011. Figure 2a shows the provincial pattern of China's urbanization level. The spatial pattern of urbanization shows the diversity in the eastern, central and western parts of China, where there is a high level of urbanization in the coastal area and northeast, and a relatively low level in central and western regions. Shanghai, Beijing and Tianjin are the top three areas in terms of urbanization level, at 89.2%, 86.2% and 80.5%, respectively. Guangdong, Liaoning, Zhejiang, Jiangsu, Fujian, Inner Mongolia and Heilongjiang are provincial regions with high urbanization levels, at 66.5%, 64.1%, 62.3%, 61.9%, 58.1%, 56.6% and 56.5%, respectively. In contrast,

urbanization levels in the central and western provincial regions are relatively low. Ten of the provincial regions with the lowest levels of urbanization are Hunan, Anhui, Xinjiang, Sichuan, Guangxi, Henan, Gansu, Yunnan, Guizhou and Tibet, with urbanization levels of 45.1%, 44.8%, 43.5%, 43.8%, 40.6%, 37.2%, 36.8%, 35% and 22.7%, respectively. A great diversity is evident in the spatial pattern, with the top 10 provincial regions having an average urbanization value of 68.2% and the bottom 10 having a value of only 38.9%.

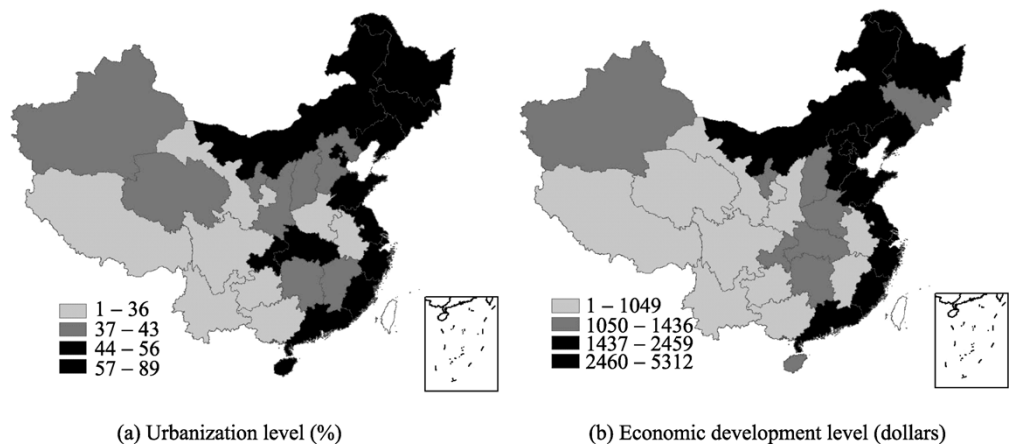


Figure 2 The provincial pattern of China’s urbanization and economic development level in 2011

### 3.2 Provincial patterns of economic development level

Like urbanization, the level of economic development developed significantly following Reform and Opening-up, and per capita GDP reached 35,181 yuan in 2011. Figure 2b shows the provincial pattern of China’s economic development, which is similar to the pattern of urbanization in that it is high in the east and relatively low in the centre and west. The top three provincial regions in terms of economic development are Tianjin, Beijing and Shanghai, with per capita GDP figures of 85,213, 82,560 and 81,658 yuan, respectively. The provincial regions in the coastal area have high levels of economic development, with Jiangsu, Zhejiang and Guangdong having values above the national average. Six of the bottom-ten provincial regions with the lowest economic development levels are in the western part of China, namely Sichuan, Guangxi, Tibet, Gansu, Yunnan and Guizhou, while three others, Henan, Jiangxi and Anhui, are in the central area. Guizhou has the lowest per capita GDP among the provincial regions, at 16,413 yuan in 2011; this is equivalent to only 20% of Tianjin’s per capita GDP, thus demonstrating the vast regional variations in economic development, variations that have been growing even larger.

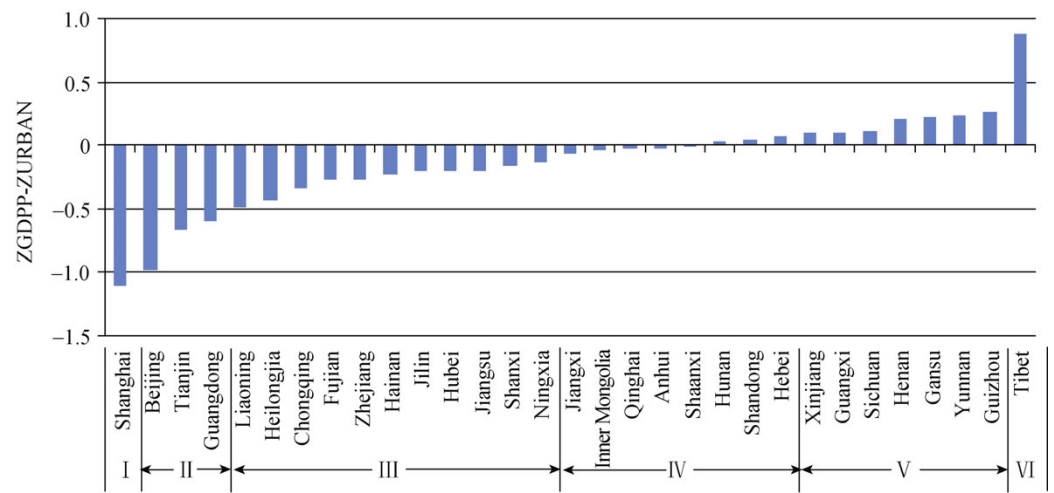
## 4 Provincial patterns of relationships between urbanization and economic development level

### 4.1 Categories of relationship

Based on the revised quadrant scatter method, the results were calculated (Table 1), with the 31 provincial regions of China being divided into six categories (Figure 3). Only Shanghai is

**Table 1** Results of the relationship between urbanization and economic development in 2011

| Region         | ZGDPP | ZURBAN | ZGDPP–ZURBAN | Sign | Region    | ZGDPP | ZURBAN | ZGDPP–ZURBAN | Sign |
|----------------|-------|--------|--------------|------|-----------|-------|--------|--------------|------|
| Beijing        | 0.35  | 1.33   | −0.98        | −    | Henan     | −0.52 | −0.73  | 0.21         | +    |
| Tianjin        | 0.40  | 1.07   | −0.66        | −    | Hubei     | −0.43 | −0.22  | −0.21        | −    |
| Hebei          | −0.43 | −0.50  | 0.07         | +    | Hunan     | −0.50 | −0.53  | 0.03         | +    |
| Shanxi         | −0.47 | −0.32  | −0.15        | −    | Guangdong | −0.16 | 0.44   | −0.60        | −    |
| Inner Mongolia | −0.04 | −0.01  | −0.03        | −    | Guangxi   | −0.57 | −0.67  | 0.10         | +    |
| Liaoning       | −0.16 | 0.33   | −0.49        | −    | Hainan    | −0.51 | −0.28  | −0.23        | −    |
| Jilin          | −0.36 | −0.15  | −0.21        | −    | Chongqing | −0.42 | −0.08  | −0.34        | −    |
| Heilongjiang   | −0.45 | −0.01  | −0.44        | −    | Sichuan   | −0.56 | −0.67  | 0.11         | +    |
| Shanghai       | 0.36  | 1.47   | −1.10        | −    | Guizhou   | −0.72 | −0.98  | 0.26         | +    |
| Jiangsu        | 0.03  | 0.23   | −0.20        | −    | Yunnan    | −0.67 | −0.90  | 0.23         | +    |
| Zhejiang       | −0.02 | 0.25   | −0.27        | −    | Tibet     | −0.66 | −1.54  | 0.88         | +    |
| Anhui          | −0.57 | −0.54  | −0.03        | −    | Shaanxi   | −0.44 | −0.43  | −0.01        | −    |
| Fujian         | −0.21 | 0.06   | −0.27        | −    | Gansu     | −0.67 | −0.88  | 0.22         | +    |
| Jiangxi        | −0.56 | −0.50  | −0.06        | −    | Qinghai   | −0.50 | −0.48  | −0.03        | −    |
| Shandong       | −0.21 | −0.26  | 0.05         | +    | Ningxia   | −0.45 | −0.31  | −0.13        | −    |
|                |       |        |              |      | Xinjiang  | −0.50 | −0.60  | 0.10         | +    |



**Figure 3** Provincial classification of the relationship between urbanization and economic development

in the category of sharp over-urbanization, while Beijing, Tianjin and Guangdong are classed as having medium over-urbanization, and 11 provincial regions – Liaoning, Heilongjiang, Chongqing, Fujian, Zhejiang, Hainan, Jilin, Hubei, Jiangsu, Shanxi and Ningxia – are slightly over-urbanized. Eight provincial regions have a basic coordination pattern, these being Jiangxi, Inner Mongolia, Qinghai, Anhui, Shaanxi, Hunan, Shandong and Hebei. There are no provincial regions classed as having sharp under-urbanization, Tibet is the only region in the medium under-urbanization category, and 7 fall into the category of slight under-urbanization, namely Xinjiang, Guangxi, Sichuan, Henan, Gansu, Yunnan and

Guizhou.

I. Sharp over-urbanization: The urbanization level of Shanghai is 89.3%, and per capita GDP is 82,560 yuan (2011). As the most economically developed and population-concentrated metropolitan area in China, Shanghai is the economic core of the Yangtze River Delta.

II. Medium over-urbanization: The urbanization levels of Beijing, Tianjin and Guangdong range from 66.5% to 86.2%, and per capita GDP ranges from 50,807 to 81,658 yuan; the average values of urbanization and per capita GDP are 77.7% and 72,559 yuan. These three provincial regions have better economic development bases, and have an important strategic status in the national development plan.

III. Slight over-urbanization: Urbanization in Liaoning, Heilongjiang, Chongqing, Fujian, Zhejiang, Hainan, Jilin, Hubei, Jiangsu, Shanxi and Ningxia ranges from 49.7% to 64.1%, and per capita GDP ranges from 28,898 to 62,290 yuan; the average values of urbanization and per capita GDP are 55.7% and 41,177 yuan. These regions are mainly in coastal areas with good economic development tendencies and sound economic bases.

IV. Basic coordination: The urbanization levels of Jiangxi, Inner Mongolia, Qinghai, Anhui, Shaanxi, Hunan, Shandong and Hebei range from 44.8% to 56.6%, and per capita GDP ranges from 25,659 to 57,974 yuan; the average values of urbanization and per capita GDP are 47.8% and 35,494 yuan. Aside from Shandong and Hebei, these provincial regions are in central China and towards the western part of the country, and have great capacity to urbanize and develop their economies.

V. Slight under-urbanization: The urbanization levels of Xinjiang, Guangxi, Sichuan, Henan, Gansu, Yunnan and Guizhou range from 35% to 43.5%, and per capita GDP ranges from 26,659 to 57,974 yuan; the average values of urbanization and per capita GDP are 39.5% and 23,640 yuan. These seven regions are mainly located in the west of China, where levels of both urbanization and economic development are relatively low.

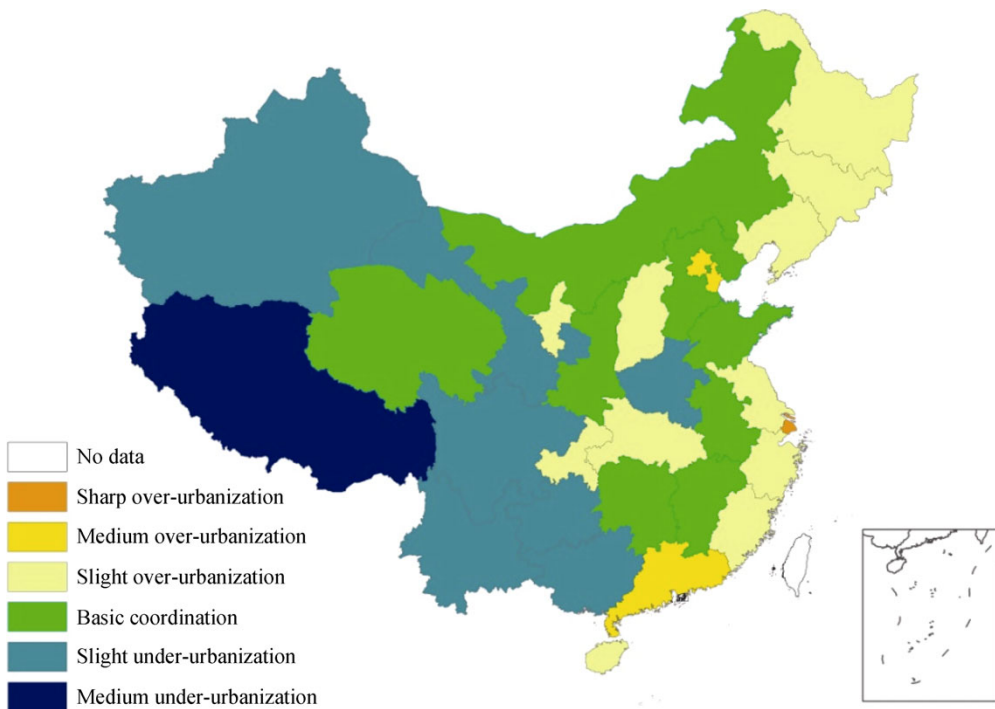
VI. Medium under-urbanization: Urbanization in Tibet is 22.7% and per capita GDP is 20,077 yuan (2011). Owing to its inferior economic base, Tibet remains in the early stage of industrialization, with a low urbanization level.

## 4.2 Provincial pattern of relationships

The provincial pattern of the relationship between urbanization and economic development can be drawn from previous results (Figure 4).

(1) There is substantial difference across regions. Based on the comparative analysis of 31 provincial regions in China in 2011, it was found that there are provincial regions in the under-urbanization, basic coordination and over-urbanization categories of various areas. With regard to the study of the relationship between urbanization and economic development, it is not sufficient simply to reveal the spatial pattern; rather, there is a need to formulate wise and reasonable development strategies and goals. Meanwhile, it is appropriate to implement different policies in different regions, given the vast regional diversity, and thus to promote the sustainable development of urbanization and the economy. This idea is in line with the Major Function-Oriented Zoning initiative, which was developed in response to the incomplete construction of the spatial planning system. This has led to a lack of coordination and

to contradictions in terms of different regional scales, and there is a great deal of confusion and many problems to solve. These include the distribution of land resource exploitation; population, industry, and urban areas; important developing axis and functional zones; and the distribution of resource conservation and ecological protection measures. Hence, there is an urgent need to achieve reasonable spatial development (Fan, 2007). Revealing the spatial pattern of the relationship between urbanization and economic development is an important basis for developing the policy for reasonable spatial development.



**Figure 4** Provincial pattern of the relationship between China's urbanization and economic development level in 2011

(2) Eight regions are under-urbanized and eight are in the basic coordination category, while 15 regions are classed as over-urbanized. The number of the basic coordination takes a large proportion and no regions are classed as having sharp under-urbanization. Hence, the overall relationship between urbanization and economic development level is basic coordinated, and urbanization does not lag far behind economic development, which verifies the former conclusions (Chen *et al.*, 2009).

(3) There is a significant difference between the east and west of the country. The coastal area consists mainly of regions of over-urbanization, such as Shanghai, Beijing, Tianjin, Guangdong, Liaoning, Fujian, Zhejiang and Jiangsu. The provincial regions in the central and western parts are mainly in the categories of under-urbanization and basic coordination. Two points can be drawn from this diversity pattern. First, the phenomenon of over-urbanization in some developed regions should be viewed with some concern and vigilance. The mainstream view holds that urbanization is far behind economic development in China, and this causes many practical development problems. So scholars and the authorities



are eager to promote urbanization, which appears to be a good way to solve these problems. Based on the present study, there are eight provincial regions of over-urbanization whose urbanization level matches that of developed countries, but with an economic development level that does not match. This phenomenon should be viewed with some concern. The focus of ever-increasing urbanization should be transferred from increasing urban numbers, urban size and urban population to increasing the quality of urbanization. Having first-class infrastructure is not sufficient for building a modernized metropolitan area; there is a need for coordinated industries, social security and living standards to effectively meet the opportunities and challenges of economic globalization. The second point is that urbanization needs to be speeded up in the central and western regions. Although under-urbanization was reduced in the initial stage of Reform and Opening-up, eight provincial regions are still in slight or medium under-urbanization category, and are located mainly in the central and western China and having low urbanization levels and a high proportion of agriculture. Hence, it would be sensible to promote urbanization in those regions in the centre and west, and new rural development policies should be combined with urbanization policies based on the diverse resource endowments of different regions to coordinate urbanization and economic development.

(4) A Matthew effect is found in the relationship pattern. As can be seen from the relationship and spatial pattern of urbanization and economic development, the coastal area, where the economic development level is very high, is mainly over-urbanized, while the centre and west are under-urbanized with a low level of economic development. The reason for this pattern is mainly the strong correlation between urbanization and economic development, but what needs to be clarified is that the quantitative relationship between urbanization and economic development is not absolutely synchronized linearity, but nonlinearity. There has been a rapid urbanization trend in the transition stage from initial to mid-term and during the mid-term stage of industrialization, and a slow urbanizing trend in the latter stage of industrialization. The vast diversity among the east, centre and west of the country reflect not only the natural endowment, but also the industrial base, economic development conditions and per capita GDP.

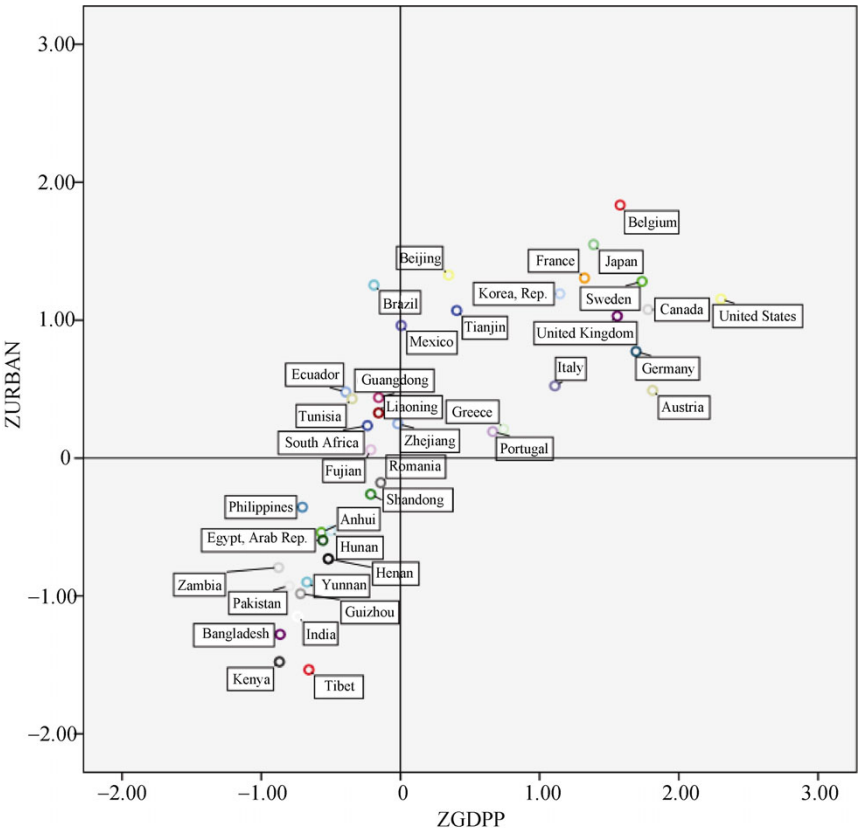
## 5 International comparisons

The urbanization levels (UL%) of the major countries in the world and some of the provincial regions in China can be divided into three categories: high urbanization, medium urbanization and low urbanization (Table 2). The results by revised quadrant scatter method are shown in Figure 5.

In the high urbanization category, the average values for urbanization and per capita GDP of Beijing and Tianjin are 83.4% and 17,953 US dollars (2011). The average values of the other 11 countries are 83.8% and 29,552 US dollars. The urbanization levels of municipalities in China are close to those of developed countries, while the economic development levels of municipalities are lagging far behind. Beijing's urbanization level is 86%, which is higher than that of the USA, Germany and some other developed countries. The urbanization and economic development levels of Brazil and Mexico are quite close to those of municipalities in China.

**Table 2** Grouped comparison of main countries and main provinces by urbanization level

| High urbanization |                    |              | Medium urbanization |                    |              | Low urbanization |                    |              |
|-------------------|--------------------|--------------|---------------------|--------------------|--------------|------------------|--------------------|--------------|
| UL%               | Country/<br>region | GDPP<br>(\$) | UL%                 | Country/<br>region | GDPP<br>(\$) | UL%              | Country/<br>region | GDPP<br>(\$) |
| 97                | Belgium            | 33,127       | 68                  | Italy              | 27,072       | 49               | Philip-<br>pines   | 3,638        |
| 91                | Japan              | 30,660       | 68                  | Austria            | 36,139       | 45               | Hunan              | 6,300        |
| 86                | Beijing            | 17,218       | 67                  | Ecuador            | 7,655        | 45               | Anhui              | 5,410        |
| 86                | France             | 29,819       | 67                  | Guangdong          | 10,713       | 44               | Egypt              | 5,547        |
| 85                | Sweden             | 35,170       | 66                  | Tunisia            | 8,258        | 41               | Henan              | 6,043        |
| 85                | Brazil             | 10,279       | 64                  | Liaoning           | 10,703       | 39               | Zambia             | 1,431        |
| 83                | Korea, Rep.        | 27,541       | 62                  | Zhejiang           | 12,493       | 37               | Yunnan             | 4,062        |
| 82                | United States      | 42,486       | 62                  | South Africa       | 9,678        | 36               | Pakistan           | 2,424        |
| 81                | Canada             | 35,716       | 61                  | Greece             | 22,301       | 35               | Guizhou            | 3,461        |
| 81                | Tianjin            | 17,967       | 61                  | Portugal           | 21,304       | 31               | India              | 3,203        |
| 80                | United Kingdom     | 32,863       | 58                  | Fujian             | 9,989        | 28               | Bangla-<br>desh    | 1,569        |
| 78                | Mexico             | 12,814       | 53                  | Romania            | 10,905       | 24               | Kenya              | 1,510        |
| 74                | Germany            | 34,603       | 51                  | Shandong           | 9,981        | 23               | Tibet              | 4,233        |



**Figure 5** The scatter diagram of ZGDPP and ZURBAN

In the medium urbanization category, the average values for urbanization and per capita GDP of Guangdong and the other five regions of China are 60.4% and 10,776 US dollars (2011). The values for Austria and the other eight countries in the list are 63.4% and 17,914 US dollars. Urbanization levels of provincial regions in coastal areas are similar to those of Austria, Portugal and Greece, but the economic development level is lagging far behind.

In the low urbanization category, the average values for urbanization and per capita GDP of Hunan, Anhui and the other six regions are 37.5% and 4918 US dollars, and those of the Philippines, Egypt and the other seven countries are 35.9% and 2716 dollars. The provincial regions with low urbanization have similar urbanization levels to those of other countries, but have much higher per capita GDP levels than other countries.

Comparing the three categories, it is suggested that the urbanization level has not lagged far behind the economic development level and the relationship vary cross regions. The coastal regions are mainly over-urbanized, and have urbanization levels greater than or similar to those in developed countries; however, their economic development levels are much lower. Less developed provincial regions are similar to other countries in the low urbanization category and higher than those countries in terms of economic development, which implies that the less economically developed provincial regions are under-urbanized.

## 6 Analysis of over-urbanization in coastal regions

Based on the analysis of per capita GDP and urbanization data for many countries, the coastal regions of municipalities and provinces are over-urbanized. This method is widely used in urbanization research; it emphasizes the horizontal comparison of data for many countries, but the analysis of the data and results should be treated reasonably with respect to different contexts (Chen *et al.*, 2007). Coastal municipalities and provinces have three special characteristics. First, from the interior urban system perspective, municipalities are in prime positions in a pyramid-like system structure, having prominent advantages in terms of policy endowment and development conditions. Under the globalization trend, metropolitan aggregation and diffusion effects will increase steadily, and some of these coastal mega cities represent the whole nation in participating in and competing with other nations directly. Secondly, it is common for the development of big cities to be prioritized in developing countries. Thirdly, spatial scale would probably have an effect on the relationship between urbanization and economic development levels. Taking the USA and Singapore as examples, although this pair has similar economic development levels, the country with the much larger national territory has not reached the deserved level of urbanization. Singapore can urbanize completely, with an urbanization level of 100%, while the USA can never achieve this goal. Furthermore, for relatively small territorial areas, it is appropriate to develop municipalities to become over-urbanized to some extent. The suggestions for mega cities are that the key development focus should move from increasing the statistical population urbanization rate to increasing the quality of urbanization, which has great potential in relation to the citizenization of rural inhabitants and the coordinated development of urban–rural areas. Moreover the reasons for the phenomenon of over-urbanization in coastal regions should be identified, and the consequences and trends driven by this phenomenon should be viewed with concern.

## 7 Conclusions and discussion

Based on data from a number of countries or regions in the world and 31 provincial regions in China, applying the revised quadrant scatter method, this paper analyzed the spatial pattern of the relationship between urbanization and economic development. The following conclusions were drawn.

(1) The 31 provincial-level regions fall into six categories. Only one is in the category of sharp over-urbanization, 3 are in medium over-urbanization, 11 slight over-urbanization, 8 basic coordination, one medium under-urbanization, and 7 slight under-urbanization.

(2) The relationship between urbanization and economic development shows significant regional differences on a provincial scale.

(3) The provincial pattern of urbanization and economic development differed significantly between east and west. The eastern coastal areas are mainly over-urbanized, while the central and western regions are mainly under-urbanized. Two important insights are proposed. First, the phenomenon of over-urbanization in some developed regions should be viewed with some concern and vigilance. Second, urbanization needs to be speeded up in the central and western regions.

(4) The relationship between urbanization and the level of economic development is similar to the Matthew effect. Regions with much better economies mostly fall into the over-urbanization category, while less developed regions are mainly under-urbanized, although the urbanization level is quite low.

Analyzing the spatial pattern of the relationship between urbanization and economic development level is beneficial for revealing objective laws of different regions and thus promoting coordinated development between urbanization and economic development. But it is far beyond the scope of this research to clarify this question sufficiently, and further studies are needed to explore how the spatial scale affects the relationship between urbanization and economic development theoretically, and how healthy urbanization and spatial sustainable development can be implemented in practical terms.

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