MEASURING URBAN COMPETITIVENESS IN CHINA

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Abstract**:** *Among Chinese cities, inter-city competition has intensified due to the emergence of a socialist market economy in post-reform China. This paper attempts to evaluate the competitiveness of 215 Chinese cities at prefecture-level or above in 1999, using a three-level hierarchical system of 55 economic, social and environmental indicators. These indicators have been chosen so that the urban competitiveness of a city can be measured in terms of its performance and explanatory indicators rather than its economic and population size. Other than economic indicators, social and environmental indicators are also counted using an equal weighting method. The urban competitiveness analysis in this paper shows that Shenzhen, Zhuhai, Shanghai, Beijing and Guangzhou were the most competitive cities in China in 1999. The relationship among three competitiveness components is revealed by a correlation analysis. There was less consistency between environmental competitiveness and economic or social competitiveness. This means that, in some cities, economic or social competitiveness does not necessarily ensure environmental competitiveness.*

Keywords: urban competitiveness, weighting method, performance indicator, explanatory indicator, China.

Introduction

Urban competitiveness has become an important issue in the modern world in recent years. Globalisation, advances in information technology and the far-reaching structural change have substantial bearing on the competitiveness of cities. Urban hierarchies are shifting radically and many cities have to confront a more precarious competition from cities of home or foreign countries. Many studies have been conducted on capitalist cities such as the metropolitan areas in the US, the conurbations in the UK and cities in other European countries (Deas and Giordano, 2001; Kresl and Singh, 1999; Lever, 1999). It has been suggested by Gordon and Cheshire (quoted in Begg, 1999) that territorial (urban) competition "may be conceived of as involving attempts by agencies representing particular areas to enhance their locational advantage by manipulating some of the attributes which contribute to their area's value as a location for various activities."

China is undergoing a transition from a planned economy towards a market economy. Urban China, as elsewhere in the world, is the core of China's economy and society where the most dramatic development is taking place. Arguably, urban competition and the political economy of urban development in China are not the same as the capitalist cities. The role of urban government is particularly important in Chinese cities (Shen, 2004a). Various city governments have been keen to promote their own cities and to lure national key projects or foreign direct investment (Wu, 2000; Shen, 2005). Whether these cities will be successful or not in their pursuit depends on their competitiveness and effective urban governance (Wang and Shen, 2002). Nevertheless,

the Chinese cities may share some common performance and explanatory indicators with western cities in defining a competitive city such as the quality of life, economic efficiency, employment growth, inflow of foreign investment and quality of human resources. Thus, conceptual and empirical studies on the competitiveness of western cities provide a useful reference for the study in the Chinese context. Further study on the unique process of urban competition in China is required. On-going study on urban governance in China would shed light on this issue (Shen, 2005).

There are a few studies on the comprehensive strengths and competitiveness of Chinese cities in recent years (Li, 2000; Ni, 2001, 2003; Yin, 2001, 2002; IUD, 2003; Bianweihui, 2003), but the concept and measurement of urban competitiveness in the context of Chinese cities have to be further examined. Many absolute indicators, total values for a city, related to city-size are often used in these studies. Furthermore, only some cities are considered in some previous studies. For example, Ni's study in 2001 focused on 24 cities in China using 88 indicators. He found that the top four cities were Shanghai, Shenzhen, Guangzhou and Beijing respectively (Ni, 2001). In a more influential recent study (Bianweihui, 2003), 50 Chinese cities are evaluated using 104 indicators. Two different indices are defined. The index of urban development potential is measured using over 100 indicators, mainly relative but also many absolute indicators. The top four cities are Shenzhen, Shanghai, Beijing and Guangzhou according to this index. The index of real urban development capacity is derived from the index of urban development potential but adjusted by using city strength index as weights. The city strength index is based on 12 indicators such as the total population and total output value. It seems that the index of urban development potential is close to the concept of urban competitiveness discussed in this paper, while the index of urban development capacity is heavily affected by the city-size.

Selection of indicators and the choice of an appropriate weighting method are two crucial stages in the empirical studies of urban competitiveness that will also affect the ranking and interpretation of the results. Following an earlier study on Chinese cities using 1997 data (Wang and Shen, 2002), this study has adopted a new set of variables and a new weighting method after comparison of several methods.

This study has selected 55 social, economic and environmental indicators that are related to the underlying factors of urban competitiveness. It attempts to use an integrated index to measure the competitiveness of 215 Chinese cities at prefecture-level or above in 1999.[1] The results of this study show that the urban competitiveness of 215 prefecture-level cities in China is systematically based on a set of carefully selected indicators and robust weighting method.

The majority of statistical data, 52 indicators, used in this research are drawn from Urban Statistical Yearbook of China (National Bureau of Statistics, 2001). This is also the most comprehensive statistical data series on Chinese cities although the statistical data may not be as accurate as expected. It is expected that the data from the same source are more likely to be consistent. The statistical data for three indicators are obtained from other sources, such as magazines and the official websites of the central and local governments in China.

System of Indicators for Measuring Urban Competitiveness

Harvey (1989: 126) recognized that "urban regions compete for employment, investment, new technologies, and like by offering unique packages of physical and social infrastructure, qualities and quantities of labour power, input costs, life-styles, tax systems, environmental qualities, and the like." Begg (1999) and Kresl and Singh (1999) also highlighted that urban competitiveness refers to the all round strengths of a city instead of a particular kind of strength alone. In a word, competitiveness of a city is sensitive to its economic performance, social development and quality of environment (Bailey et al., 2002; Begg, 2002). Since the competitiveness of a city is originated from various sources and the outcomes derived from competitiveness show in every area of a competitive urban economy, a single indicator alone is not sufficient enough to capture the attributes of urban competitiveness. As far as this issue is concerned, multiple indicators are usually selected to evaluate the urban competitiveness in previous studies, for example by Deas and Giordano (2001), Ni (2001) and IUD (2003). This paper argues that social, economic and environmental indicators have to be taken into consideration in the assessment of urban competitiveness. Good economic performance does not necessarily guarantee high quality of life. A competitive city must be doing well economically with good social facility and structure, as well as good quality of environment. Such criteria apply to both Chinese cities and western cities.

Furthermore, aggregated indicators such as total GDP (Gross Domestic Product) and total population often reflect the size of a city rather than its competitiveness. Such size-based indicators should be avoided, otherwise what is being measured is just the size of a city instead of urban competitiveness. The issue becomes even more problematic in the Chinese case as an administrative change in urban boundary may result in an increase in the size of GDP and population (Shen, 2004; 2005). As mentioned before, previous studies on Chinese cities often use total GDP and total population in the evaluation of urban competitiveness. This study avoids using such indicators to get more reliable results.

In this paper, the competitiveness of 215 Chinese cities at prefecture-level or above in 1999 are measured, based on a three-level system of indicators, which is illustrated in Figure 1. At Level I, there are three competitiveness components, which are economic (EC), social (SC) and environmental (GC) competitiveness components. These three competitiveness components are further broken down at Level II into ten subgroups, which are growth of urban economic capacity (E1), economic performance (E2), economic structure (E3), urban development (S1), education and training (S2), social security (S3), quality of life (S4) and government efficiency (S5), waste treatment (G1) and quality of environment (G2). At Level III, 55 explanatory and performance indicators are organized into different subgroups according to their nature. Table 1 presents the list of 55 indicators used in this study.

Economic Competitiveness Component

a. Growth of urban economic capacity

The economic competitiveness component of a city is measured by three subgroups, i.e. the growth of urban economic capacity, the economic performance and the economic structure. It is generally recognized that an individual city with strong economic

capacity would probably be competitive. A subset of 10 indicators concerning such production factors as capital and labour is used to assess the economic capacity of an individual city.

Capital investment is essential for economic growth and often facilitates the use of advanced technology. A high technological level can significantly improve the production efficiency and enhance the competitiveness. A city with a large capital investment implies that its investment environment is attractive and competitive. Thus, four indicators, including actually utilized foreign investment (1), actually utilized foreign investment per capita (2), scale of domestic investment (3) and domestic investment per capita (4), are selected to measure the level of capital investment. The total foreign investment and the scale of domestic investment of a city are used here. It is argued that city-size is not the main determinant of the scale of investment. For example, foreign investment depends on various factors such as location, economic foundation and government policy. A large city does not guarantee a large amount of investment. This also applies to a few other absolute indicators used in this study.

In addition to private investment, public fund is crucial to the development of a city's economic capacity. Local governments with larger budgetary revenue tend to provide better public service and infrastructures that are vital to the competitiveness of a city. Thus, budgetary revenue of local government (5) is also chosen.

An urban area with dynamic companies and strong growth potential will tend to perform better as they are the sources of employment, production and export. Only large and powerful enterprises are listed in stock markets. Indeed, these enterprises are the focal points of human resources, capital and technology. Thus, the number of headquarters of top 100 listed enterprises (6) in China is used. Growth in employment is also an important indicator of a competitive city. Thus, the increase in the scale of urban employment within a single year (7) is used.

Finally, education as well as innovation and technology are strongly emphasized by local governments in their policy agenda for enhancing their urban competitiveness. Thus, the number of student enrolment in tertiary institutions (8), number of tertiary institutions (9) and a local government's budgetary expenditure on science and technology (10) are used.

b. Economic performance

Strong economic capacity is definitely not equivalent to outstanding economic performance. Therefore, 7 indicators are selected to measure such economic performance. A city's overall economic performance can be indicated by both GDP per capita (11) and GDP growth rate (12). It is noted that GDP per capita is affected by the problem of the data on total population as the official data usually do not include temporary population. Fortunately, only a few indicators are calculated on per capita basis and their impact on the overall urban competitiveness may be small. For example, Zhuhai has a much smaller temporary population than Shenzhen. But it is still ranked second, just after Shenzhen, in the overall urban competitiveness. With the release of 2000 census data, the temporary population can be included in further studies.

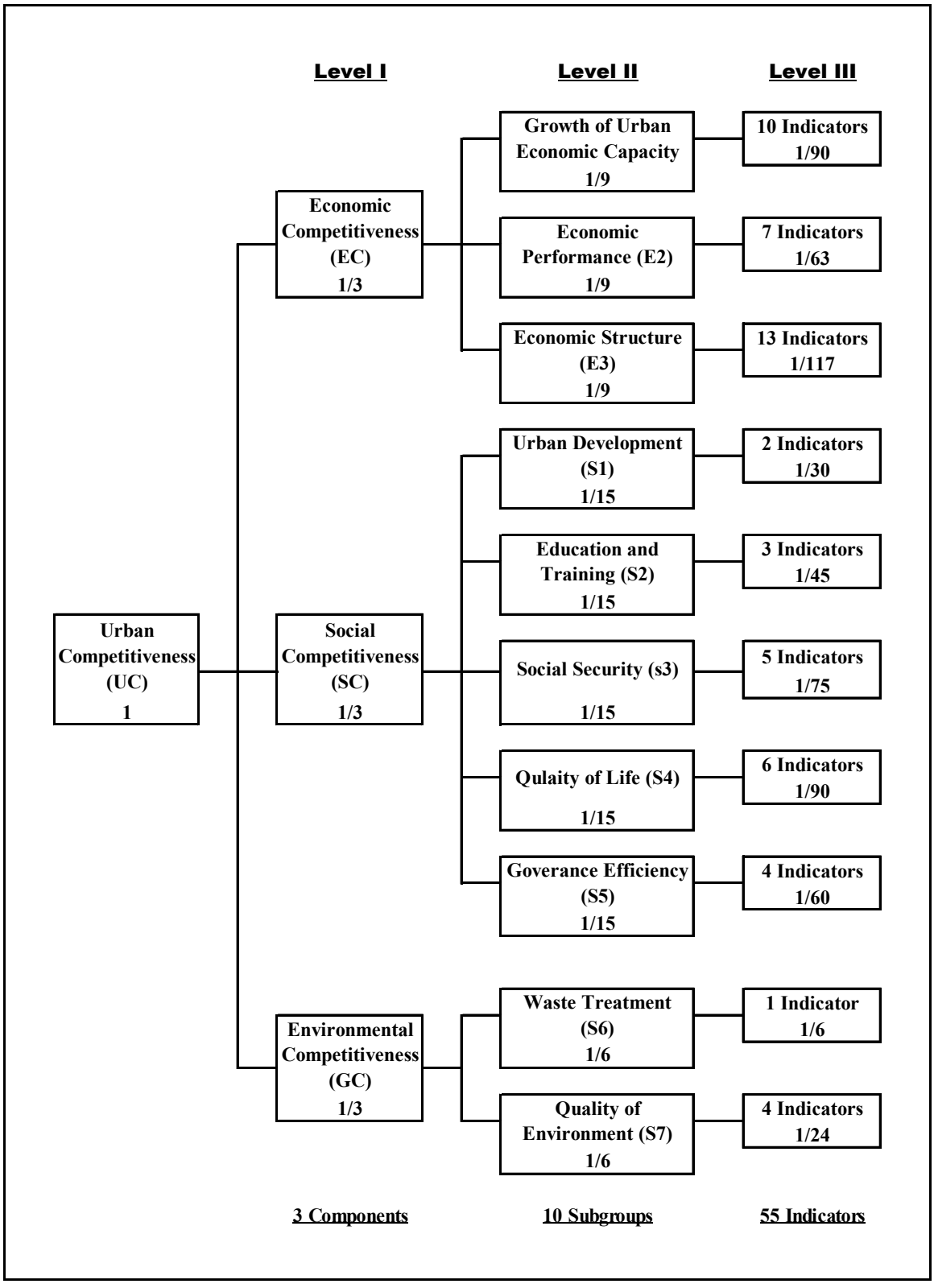

Figure 1. The three-level hierarchical system of indicators and weights based on equal weighting method.

Table 1. 55 indicators in 10 economic, social and environmental subgroups.

Growth of Urban Economic Capacity (E1)	**Urban Development (S1)**
1 Actually utilized foreign investment	31 Level of urbanization
2 Actually utilized foreign investment per capita	32 Population density
3 Scale of domestic investment	**Education and Training (S2)**
4 Domestic investment per capita	33 Percentage of student enrollment in secondary schools
5 Budgetary revenue of local government	34 Ratio of students to teachers in primary schools
6 Number of headquarters of Top 100 listed enterprises	35 Budgetary expenditure of local governments on education per capita
7 Increase in the scale of urban employment	**Social Security (S3)**
8 Number of student enrollment in tertiary institutions	36 Number of doctors per 1 000 persons
9 Number of tertiary institutions	37 Number of hospital beds per 1 000 persons
10 Local government's budgetary expenditure on science and technology	38 Unemployment rate
Economic Performance (E2)	39 Bank savings per capita
11 GDP per capita	40 Insurance premium per capita
12 GDP growth rate	
13 Value-added tax rate of assets	**Quality of Life (S4)**
14 Average wages of staff and workers	41 Living space per capita
15 Total sales of wholesale and retail per capita	42 Road density
16 Retail sales of consumer goods per capita	43 Number of public transportation vehicles per 1 000 persons
17 Contribution of international tourism to GDP	44 Percentage share of households with access to telephone sets
Economic Structure (E3)	45 Number of cinemas and theatres per 1 000 persons
18 Percentage share of secondary sector in GDP	46 Number of public library books per capita
19 Percentage share of secondary sector in total employment	**Government Efficiency (S5)**
20 Percentage share of employment in manufacturing in urban labour force	47 Budgetary revenue of local government per capita
21 Percentage share of employment in construction in urban labour force	48 Ratio of total population to employees working in government and public institutions
22 Percentage share of tertiary sector in GDP	49 Availability of official website of local government
23 Percentage share of tertiary sector in total employment	50 Percentage change of employees in government and public institutions
24 Percentage share of employment in wholesale and retailing in urban labour force	**Waste Treatment (G1)**
25 Percentage share of employment in finance and insurance in urban labour force	51 Percentage of industrial sewage discharged meeting national standard
26 Percentage share of employment in real estate and property in urban labour force	**Quality of Environment (G2)**
27 Percentage share of employment in education, culture and broadcasting in urban labour force	52 Amount of SO_2 per unit of area
28 Percentage share of employment in research and technology in urban labour force	53 Percentage of area meeting national standard of environmental noise
29 Percentage share of manufacturing output of Hong Kong, Macao and Taiwan invested enterprises in total manufacturing output by enterprises over certain limit	54 Percentage of green space in the built-up area
30 Percentage share of manufacturing output of foreign invested enterprises in total manufacturing output by enterprises over certain limit	55 Area of parks and green areas per capita

More specifically, the economic performance and monetary benefits of enterprises and workers can be illustrated by value-added tax rate of assets (13) and the average wage of workers (14) respectively.

The robustness of a city's market can be measured by its total sales of wholesale and retail per capita (15) and retail sales of consumer goods per capita (16). International tourism is a kind of intangible trade. Revenue from tourism would be limited unless the city is able to make use of its place-based assets. Thus, contribution of international tourism to GDP (17) can serve as an indicator showing a city's performance in tourism.

c. Economic structure

Kresl (1995) emphasized that the economic structure, particularly the role played by foreign-owned firms and the diversification of producer services, is crucial to the competitiveness of a city. Thus, by studying the sectoral trends in an individual city, the progress of a city in evolving into a competitive economy and its prospects can be assessed. It is believed that the contribution of tertiary sector to GDP and the proportion of employees working in this sector will be larger if this city has a more competitive economy. Accordingly, the percentage shares of secondary and tertiary sectors in both GDP and total employment (18, 19, 22, 23) are selected.

A large stock of technical, scientific, managerial and entrepreneurial personnel engaged in various sectors and a wide range of producer services are two key factors of a competitive city. Thus, the percentage shares of employment in urban labour force in 7 specific sectors, which are manufacturing (20), construction (21), wholesale and retail (24), finance and insurance (25), real estate and property (26), education, culture and broadcasting (27) and research and technology (28), are selected.

The competitiveness of an individual city will benefit from an active private sector and an open economy. Thus, the percentage share of manufacturing output of Hong Kong, Macao and Taiwan invested enterprises (29) and that of foreign invested enterprises (30) in total manufacturing output are selected.

Social Competitiveness Component

a. Urban development

The social competitiveness component of a city is measured by five subgroups, i.e. urban development, education and training, social security, quality of life and government efficiency. This sub-section focuses on urban development first. The urban condition varies among Chinese cities as the degree of urbaneness depends on the scope of the administrative area of a city. A more urbanized city usually has a high proportion of non-agricultural population in the total population and a high population density.

In this study, the level of urbanization in a city is defined as the proportion of non-agricultural population in the total population. The status of non-agricultural population is still important although the state privileges for the population with such *hukou* (household registration) have been reduced in the reform period (Shen et al., 2002). The

share of non-agricultural population in a city represents an important dimension of urbanization. Thus, the level of urbanization (31) and population density (32) are selected to indicate the progress of urbanization and urban development of an individual city.

b. Education and training

Innovation and learning have become the buzzwords in the contemporary knowledge-based economy. Most governments put a strong emphasis on education and training in their policy agenda. The performance of an economy can benefit from a labour force of high quality. Accordingly, the percentage of student enrolment in secondary schools (33), the ratio of students to teachers in primary schools (34) and budgetary expenditure of local governments on education per capita (35) are selected to measure the provision and quality of basic education as well as the inputs on education and training.

c. Social security

The most significant aspects of social security are the state of public health, the urban employment condition and the savings of the public. There is a direct link between public health and the competitiveness of an individual city. Thus, the number of doctors per 1 000 persons (36) and the number of hospital beds per 1 000 persons (37) are selected to assess the quality of medical services of a city.

Urban China has a high unemployment rate due to the state-owned enterprise (SOE) reform and large labour flow from the countryside to the city. The increasing unemployment will also affect social stability. Therefore, unemployment rate (38) is selected.

Due to the economic reform and open policy since 1978, life-long employment is no longer assured by the government. With uncertain employment, medical cost and elderly support, citizens nowadays have to make their own financial planning. Savings and insurance are two useful measures. Thus, bank savings per capita (39) and insurance premium per capita (40) are selected to indicate these two sources of protection.

d. Quality of life

No one is willing to stay there, let alone talking about being competitive, if a city is not able to satisfy the needs of its people. Comfortable living environment and adequate transport and telecommunication facilities have become two crucial factors of quality of life.

A series of benefits derived from agglomeration effect will be offset once a city goes beyond certain city size. One of the most acute problems is an overcrowding living environment. Here, living space per capita (41) is selected to indicate how spacious the living environment is.

The infrastructure needs depend on the role of the city and its development stage. However, education and culture as well as transport and telecommunication are the two basic supporting infrastructures a city has to develop. Regarding the basic needs of

humankind and the global trend, road density (42), the number of public transportation vehicles per 1 000 persons (43), the percentage share of households with access to telephone sets (44), the number of cinemas and theatres per 1 000 persons (45) and the number of public library books per capita (46) are selected to measure the quality of infrastructure and public facility provided by a city.

e. Government efficiency

It is certain that there is a definite relationship between the efficiency of a government and the competitiveness of a city. A competitive city is normally supported by a responsible and efficient government whose bureaucrats are open-minded to accept fresh ideas from the outsiders and capable of formulating and executing effective public policies related to economic capacity, employment, education, public health, welfare services and environment, which are all vital to the competitiveness of an individual city. It is undeniable that there is no direct way to evaluate the government efficiency. However, it seems that the budgetary revenue of a local government, the bureaucratic structure and the transparency of the government can serve as the proxy measures of government efficiency.

Thus, the budgetary revenue of a local government per capita (47) is selected to indicate the government efficiency. The ratio of total population to employees working in government and public institutions (48) and the percentage change of employees in government and public institutions (50) are selected to assess the government efficiency in terms of the size of its bureaucratic structure. Here, the public institutions refer to various social organizations such as women's association funded by the government but do not include the state-owned enterprises.

Nowadays, the Internet is becoming ubiquitous in any knowledge-based economy. A government without any online service is an inefficient one. A local government website serves as a platform for interaction between the government and the local public. Accordingly, whether local government has official websites (49) is selected as a proxy measure of government efficiency.

Environmental Competitiveness Component

a. Waste treatment

It is difficult to get systematic environmental data for all cities in this study. The environmental competitiveness component of a city is measured by two subgroups, i.e. waste treatment and the quality of environment, using a total of 5 indicators. This sub-section focuses on the waste treatment sub-group first. A city with outstanding economic performance and social development is often considered competitive. However, a city with excessive economic growth and development at the expense of the environment is not a competitive community. Thus, the percentage of industrial sewage discharge meeting national standard (51) is selected to show how well an individual city manages the waste that it generates to lessen the pressure on the environment.

b. Quality of environment

As mentioned above, a city is not competitive unless its economic growth and urban development are compatible with its environment. A green city free from pollution is more competitive than a city suffering from deteriorating environmental quality. In fact, urban community with fresh air, clean and safe drinking water and tranquil environment is desired by most urban dwellers. Thus, the amount of SO_2 emission per unit of area (52) and the percentage of area meeting the national standard of environmental noise (53) are employed to measure the extent of pollution in a city. In addition, the percentage of green space in the built-up area (54) and area of parks and green areas per capita (55) are used to show the greenness of a city.

Weighting Method for Measuring Urban Competitiveness

In this study, 55 explanatory and performance indicators in 10 different subgroups are used to measure the urban competitiveness of a city. How to weight various indicators to derive a comprehensive index of urban competitiveness is a key issue in this research. Apart from urban competitiveness, multiple indicators are often used to measure national competitiveness, quality of life and comprehensive strengths of a city. Objective weighting methods such as Equal Weighting (EW), Principal Component Analysis and Weighting based on Standard Deviation (SD) are often used to weight various indicators (International Institute for Management Development, 2000; Huggis, 2002; Marlin et al., 1986; Li, 2000; Ni, 2001; Wang and Shen, 2002). Three independent weighting methods, i.e. EW, SD and Factor Analysis (FA) are considered to weight various indicators in this research. The procedures of these three weighting methods are outlined as follows.

As illustrated in Figure 1, urban competitiveness is broken into three competitiveness components at Level I. Using EW method, economic, social and environmental competitiveness components carry equal weight, so the weight assigned to each component is 1/3 and it will not be affected by the number of indicators used in each component. At Level II, these three competitiveness components are further divided into ten subgroups. For example, there are three economic subgroups, whose weights are 1/9 each which is equal to (1/3)/3. At Level III, a series of 55 quantitative indicators are embodied into these ten subgroups. For instance, there are ten indicators in the economic subgroup "Growth of Urban Economic Capacity". The weight for each indicator in this subgroup is 1/90 which is equal to (1/9)/10. The weights for other indicators can be obtained similarly.

The second weighting method used in this research is SD method. The procedure is as follows. First, all the statistical data at Level III is standardized, so that their values range from minimum at 1 to maximum at 100. Then, the standard deviation for each indicator is enumerated and the total standard deviations in each subgroup are obtained. The weight for each indicator is the share of its standard deviation to the total standard deviation in this subgroup. Similarly, the weights for other indicators, subgroups and competitiveness components can be obtained.

FA method is generally regarded as a technique to simplify complex data sets so that a series of indicators are reduced into several main factors. In this research, 14 factors are

extracted from 55 indicators. The weight assigned to each factor is the percentage share of its variance to total variance.

The three-level hierarchical system of indicators shown in Figure 1 can be maintained when EW and SD methods are employed to calculate the urban competitiveness. However, it is difficult to keep this system when FA method is used. By using the FA method, a series of 55 statistical indicators are reduced to a smaller set of 14 main factors. In order to preserve the above hierarchical system of indicators, factor analysis is applied to indicators in economic, social and environmental competitiveness components respectively. But factor analysis only works for economic indicators as there are only a few indicators in the subgroups of social and environmental components. Factor analysis is used on the statistical indicators within each of the three economic subgroups (FA1) on the one hand. On the other hand, it is also conducted for all economic indicators (FA2).

The urban competitiveness scores based on EW and SD methods are very consistent as shown in Figure 2. Their correlation coefficient is as high as 0.988. The urban competitiveness score obtained using FA method is less consistent with those based on EW or SD, though the correlation coefficients are still as high as 0.807 and 0.767 respectively. All correlation coefficients are highly significant at 0.01 level. A major reason for above difference is that these 55 original indicators are regrouped into 14 factors by factor analysis. Unlike other two weighting methods, weights are given to the factors rather than the indicators by FA method.

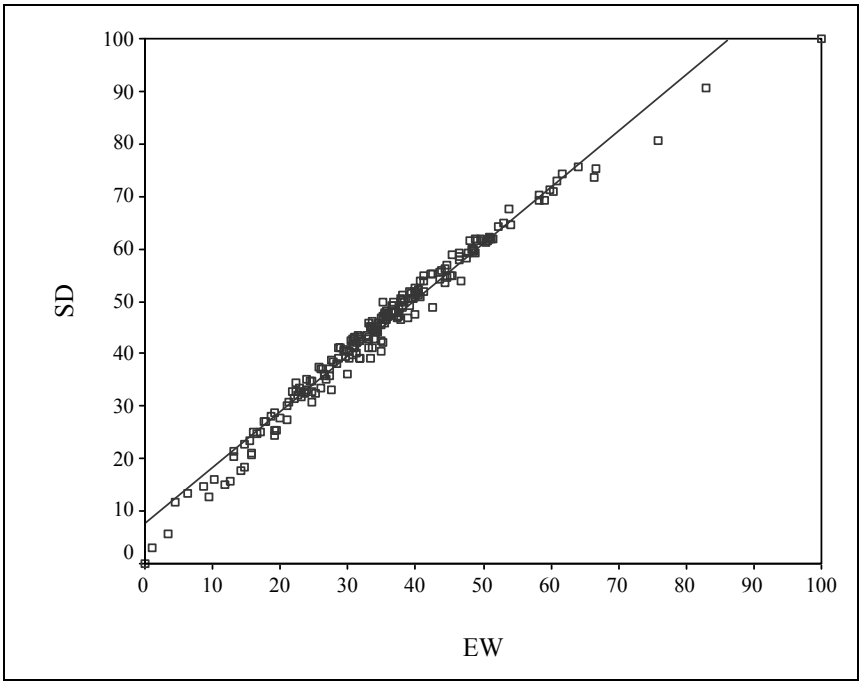

Figure 2. Relationship between urban competitiveness scores based on EW and SD methods.

There is no significant difference in economic competitiveness component between the results derived from two kinds of factor analyses (FA1 and FA2) as their correlation coefficient is as high as 0.971, significant at 0.01 level. Besides, no matter which factor analysis is used, the economic competitiveness scores based on FA method are less

consistent with those based on EW or SD methods. Similar to the urban competitiveness score, there is strong consistency in economic, social and environmental competitiveness scores based on EW and SD methods with correlation coefficients of 0.992, 0.973 and 0.997 respectively, significant at 0.01 level.

The discussion in the following section will use the results based on the EW method although there is no significant difference in the results of the three different methods. Indeed, the limitations of SD and FA methods make EW method a more appropriate weighting method to derive a comprehensive index of urban competitiveness. In the SD method, the weight assigned to a particular indicator, subgroup or competitiveness component is based on the standard deviation of the values of 215 cities. In other words, the larger is the standard deviation, the higher is the weight. However, an indicator with the largest standard deviation is not necessarily the most important one in urban competitiveness.

Similarly, the factors derived from factor analysis are not necessarily the "most important" ones, but just the ones capturing the statistical nature of the original dataset. Wang and Shen (2002) pointed out that there is a definite link between the weight and the number of similar indicators in a dataset. Certainly the largest number of indicators sharing similar characteristics will be identified as the first principal factor, whose weight will be the highest. But whether such weight reflects the significance of this factor for urban competitiveness is doubtful. The choice and kinds of indicators have much impact on the result. Thus, the importance of the indicators may be overvalued or underestimated.

Results of Urban Competitiveness Analysis

The results of urban competitiveness analysis in this paper show that Shenzhen, followed by Zhuhai, Shanghai, Beijing and Guangzhou, was the most competitive cities in China in 1999. Before going into details of specific cities, it is useful to examine the relationship among the economic, social and environmental competitiveness indices among the 215 cities in China.

The relationship among the three competitiveness components is revealed by a correlation analysis. As shown in Figure 3, the economic and social competitiveness indices were only moderately correlated with Pearson correlation coefficient of 0.569. The correlation coefficient between economic and environmental competitiveness indices was only 0.333 and the correlation coefficient between social and environmental competitiveness indices was 0.385. Although these correlation coefficients were significant statistically at 0.01 level indicating some relationship among three components of competitiveness, the relationship is not very close.

Figures 4 and 5 clearly show that there was less consistency between environmental competitiveness and economic or social competitiveness. This means that, in some cities, economic or social competitiveness does not necessarily ensure environmental competitiveness. Ideally, a competitive city is characterized by remarkable economic performance, satisfactory social development and quality urban environment. Nonetheless, few cities are competitive in all aspects. To develop a sustainable city, the urban government, enterprises and the public should work together to improve economic, social and environmental competitiveness in the meantime.

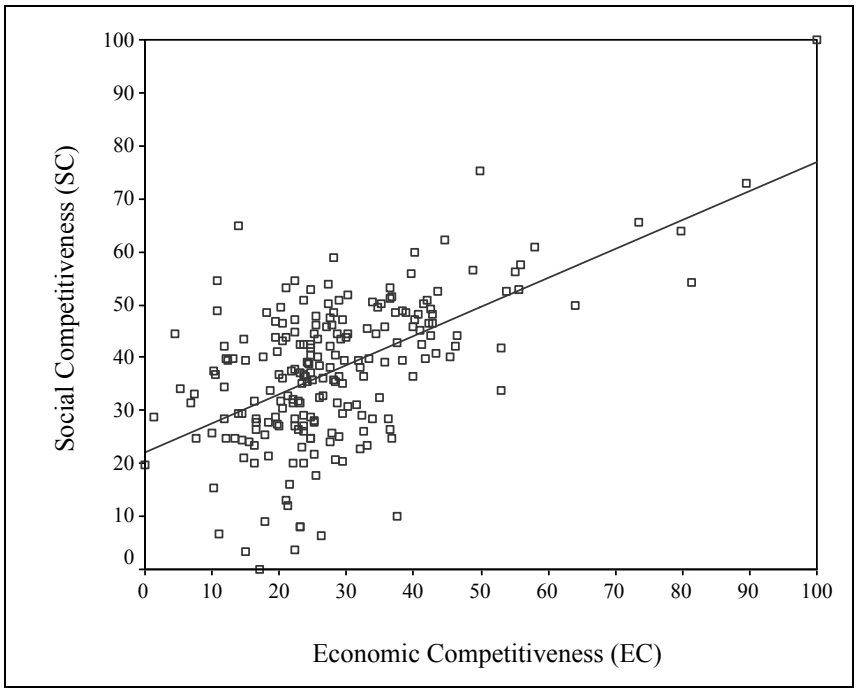

Figure 3. The relationship between the economic and social competitiveness.

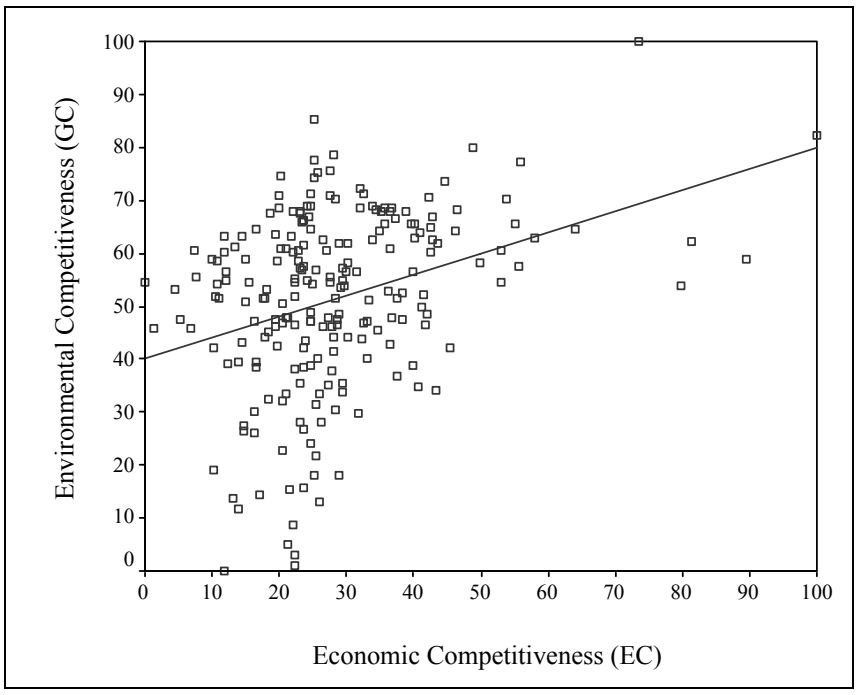

Figure 4. The relationship between the economic and environmental competitiveness.

A list showing the urban competitiveness indices of the top 50 cities are provided in Table 2. The outstanding economic performance, satisfactory social development and pleasant urban environment have earned Shenzhen a reputation of a competitive city in previous studies on urban competitiveness conducted by mass media, research institutes and consulting firms.

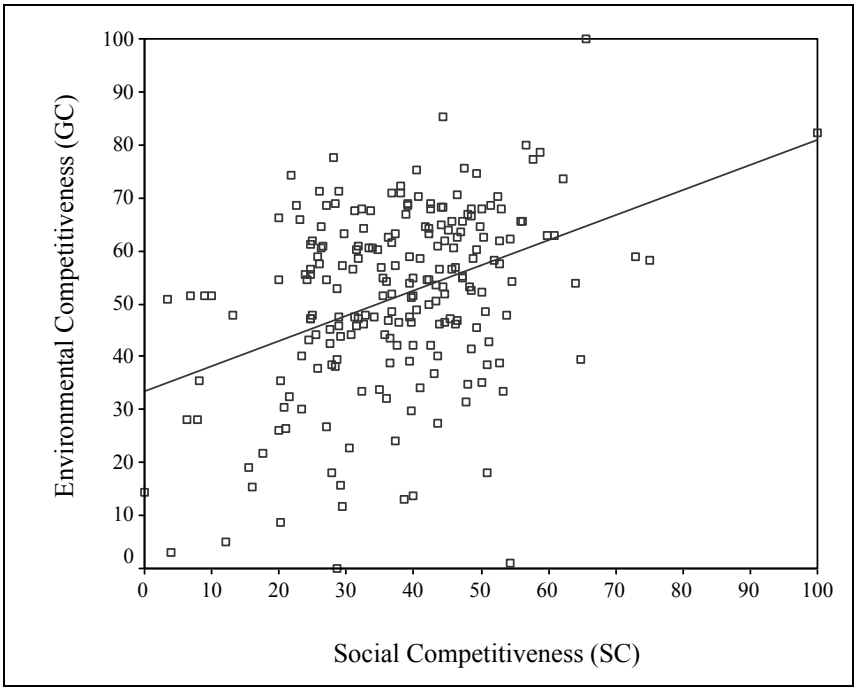

Figure 5. The relationship between the social and environmental competitiveness.

Table 2. The urban competitiveness of top 50 cities.

City	Province	City status	UC Rank	UC Scores	City	Province	City Status	UC Rank	UC Scores
Shenzhen	Guangdong	Pro-provincial	1	100.00	Guiling	Guangxi	Prefecture	26	49.03
Zhuhai	Guangdong	Prefecture	2	82.97	Zhenjiang	Jiangsu	Prefecture	27	48.93
Shanghai	Shanghai	Provincial	3	75.86	Kunming	Yunnan	Prefecture	28	48.77
Beijing	Beijing	Provincial	4	66.70	Qingdao	Shandong	Pro-provincial	29	48.61
Guangzhou	Guangdong	Pro-provincial	5	66.48	Hefei	Anhui	Prefecture	30	48.57
Hangzhou	Zhejiang	Pro-provincial	6	63.94	Changchun	Jilin	Pro-provincial	31	48.46
Wuxi	Jiangsu	Prefecture	7	61.72	Zhengzhou	Henan	Prefecture	32	48.41
Foshan	Guangdong	Prefecture	8	60.86	Xinxiang	Henan	Prefecture	33	48.00
Nanjing	Jiangsu	Pro-provincial	9	60.29	Putian	Fujian	Prefecture	34	47.74
Haikou	Hainan	Prefecture	10	59.82	Quanzhou	Fujian	Prefecture	35	47.62
Xiamen	Fujian	Pro-provincial	11	58.98	Huizhou	Guangdong	Prefecture	36	46.81
Fuzhou	Fujian	Prefecture	12	58.29	Qinhuangdao	Hebei	Prefecture	37	46.54
Suzhou	Jiangsu	Prefecture	13	58.18	Wuzhou	Guangxi	Prefecture	38	46.54
Tianjin	Tianjin	Provincial	14	53.98	Yangzhou	Jiangsu	Prefecture	39	46.48
Luohe	Henan	Prefecture	15	53.77	Xiangfan	Hubei	Prefecture	40	45.48
Shijiashuang	Hebei	Prefecture	16	52.94	Shenyang	Liaoning	Pro-Provincial	41	45.37
Changzhou	Jiangsu	Prefecture	17	52.21	Zhongshan	Guangdong	Prefecture	42	45.16
Dalian	Liaoning	Pro-provincial	18	51.39	Weihai	Shandong	Prefecture	43	44.67
Ningbo	Zhejiang	Pro-provincial	19	51.10	Chengdu	Sichuan	Pro-provincial	44	44.65
Changsha	Hunan	Prefecture	20	50.98	Jiangmen	Guangdong	Prefecture	45	44.29
Shantou	Guangdong	Prefecture	21	50.82	Xuzhou	Jiangsu	Prefecture	46	44.24
Daqing	Heilongjiang	Prefecture	22	50.66	Baoding	Hebei	Prefecture	47	43.83
Shaoxing	Zhejiang	Prefecture	23	50.52	Harbin	Heilongjiang	Pro-provincial	48	43.54
Jinan	Shandong	Pro-provincial	24	49.76	Lianyungang	Jiangsu	Prefecture	49	43.47
Shiyan	Hubei	Prefecture	25	49.69	Anyang	Henan	Prefecture	50	42.48

Note: UC: Urban Competitiveness.

The urban competitiveness of the top cities, such as Shenzhen, Zhuhai, Shanghai, Beijing and Guangzhou, are particularly high while the competitiveness of the bottom cities, such as Guangan, Guigang, Leshan, Wuzhong and Liupanshui, are particularly low. According to Table 2, the urban competitiveness scores plunged dramatically by almost 50% from 100 to 50.52 between the top city and city ranked 23rd. The curve showing the urban competitiveness scores of 215 Chinese cities in Figure 6 demonstrates that there was a rapid drop in the score at the upper end and the bottom end while the score diminished moderately in the middle part. This means that the competitiveness of most cities is rather close.

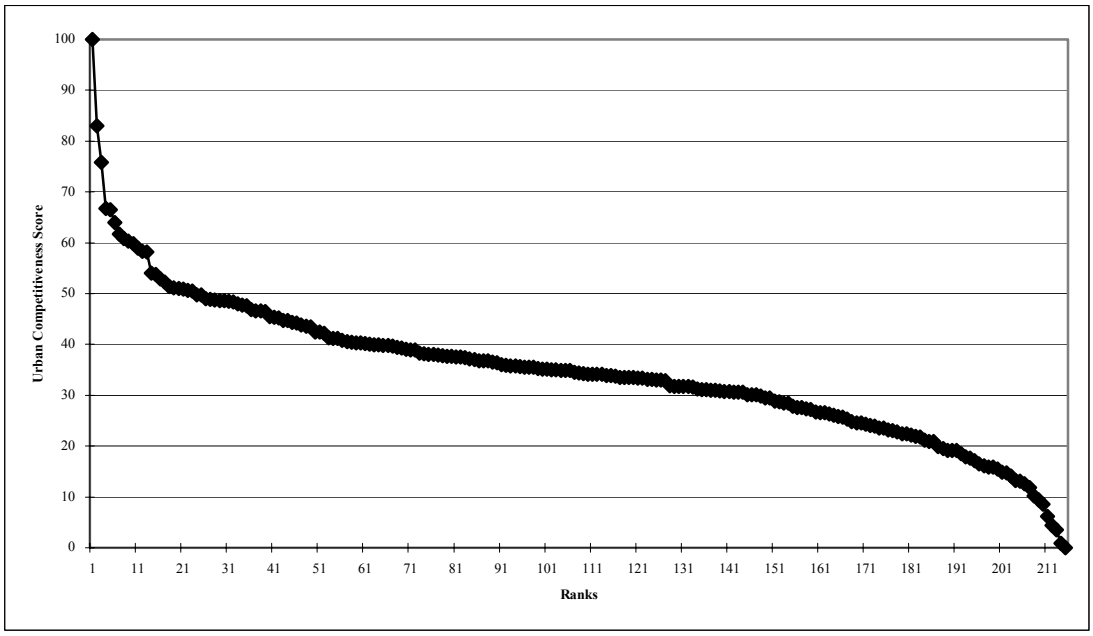

Figure 6. Urban competitiveness of Chinese cities.

By examining the values of various competitiveness components, subgroups and indicators that are used to evaluate the competitiveness of cities, some clues of why a city has high or low competitiveness can be obtained. Though 215 Chinese cities are included in this study, it is not possible to discuss every city effectively in this paper. Accordingly, the factors behind high and low competitiveness of Chinese cities are explored by comparing the top 20 and bottom 20 cities in this paper.

As mentioned already, the overall urban competitiveness is inextricably tied with the economic, social and environmental competitiveness. In fact, as seen from Table 3, the top 20 cities are characterized with all round strengths in economic, social and environmental domains in comparison with the bottom 20 cities. It is clear that the competitive strengths of the top cities are built on their relatively strong economy and society. Economically, supported by large-scale domestic and foreign investment, the top cities show spectacular GDP growth, magnificent performance in trade and tourism and expanding tertiary and service sectors. Many talents and professionals in the top cities also contribute significantly to their productivity and hence their competitiveness. On the other hand, the globalisation impact is also significant in the top 20 cities, where there is a large external sector with investment from Hong Kong, Macao, Taiwan and

other foreign countries or regions. Such external sector does not exist in the bottom 20 cities. Understandingly, headquarters of top 100 listed enterprises in China cluster in such top cities as Shenzhen and Shanghai, whilst none of them are found in the bottom cities (Yazhou Zhoukan, 1999).

Table 3. The urban competitiveness, economic competitiveness, social competitiveness and environmental competitiveness of top 20 and bottom 20 cities.

City	Province	City status	UC		EC		SC		GC	
			Rank	Scores	Rank	Scores	Rank	Scores	Rank	Scores
Top 20 Cities										
Shenzhen	Guangdong	Pro-provincial	1	100.00	1	100.00	1	100.00	3	82.27
Zhuhai	Guangdong	Prefecture	2	82.97	5	73.57	4	65.58	1	100.00
Shanghai	Shanghai	Provincial	3	75.86	2	89.45	3	72.88	79	58.83
Beijing	Beijing	Provincial	4	66.70	3	81.27	17	54.33	62	62.35
Guangzhou	Guangdong	Pro-provincial	5	66.48	4	79.80	6	63.93	110	53.69
Hangzhou	Zhejiang	Pro-provincial	6	63.94	8	55.95	11	57.66	7	77.37
Wuxi	Jiangsu	Prefecture	7	61.72	15	48.73	12	56.66	4	79.96
Foshan	Guangdong	Prefecture	8	60.86	14	49.89	2	75.16	84	58.12
Nanjing	Jiangsu	Pro-provincial	9	60.29	7	58.00	8	60.81	58	62.91
Haikou	Hainan	Prefecture	10	59.82	19	44.66	7	62.33	12	73.56
Xiamen	Fujian	Pro-provincial	11	58.98	6	64.05	35	49.76	48	64.62
Fuzhou	Fujian	Prefecture	12	58.29	10	55.14	13	56.11	45	65.43
Suzhou	Jiangsu	Prefecture	13	58.18	11	53.84	24	52.38	20	70.18
Tianjin	Tianjin	Provincial	14	53.98	9	55.52	22	52.69	86	57.56
Luohe	Henan	Prefecture	15	53.77	87	27.99	10	58.76	5	78.46
Shijiashuang	Hebei	Prefecture	16	52.94	33	40.24	9	59.84	57	63.04
Changzhou	Jiangsu	Prefecture	17	52.21	37	39.72	14	55.93	43	65.62
Dalian	Liaoning	Pro-provincial	18	51.39	26	42.14	53	46.53	18	70.52
Ningbo	Zhejiang	Pro-provincial	19	51.10	16	46.33	70	44.03	28	68.11
Changsha	Hunan	Prefecture	20	50.98	20	43.48	23	52.67	63	62.00
Bottom 20 Cities										
Guangan	Sichuan	Prefecture	215	0.00	142	22.42	213	3.83	213	2.84
Guigang	Guangxi	Prefecture	214	0.94	178	17.11	215	0.00	207	14.38
Leshan	Sichuan	Prefecture	213	3.53	154	21.15	206	11.99	212	4.89
Wuzhong	Ningxia	Prefecture	212	4.38	201	11.70	160	28.48	215	0.00
Liupanshui	Guizhou	Prefecture	211	6.20	206	10.21	204	15.46	202	19.11
Yanan	Shaanxi	Prefecture	210	8.59	150	22.06	198	20.18	211	8.62
Beicheng	Jilin	Prefecture	209	9.41	152	21.65	203	15.94	206	15.34
Shizuishan	Ningxia	Prefecture	208	10.21	193	13.82	151	29.52	210	11.61
Neijiang	Sichuan	Prefecture	207	11.89	135	23.20	210	7.94	194	28.07
Nanchong	Sichuan	Prefecture	206	12.57	100	26.34	212	6.32	193	28.25
Tianshui	Gansu	Prefecture	205	13.06	188	14.80	195	21.06	197	26.31
Zhangjiajie	Hunan	Prefecture	204	13.16	182	16.33	199	20.01	198	26.08
Shaoyang	Hunan	Prefecture	203	14.05	106	25.38	202	17.63	201	21.66
Fangchenggang	Guangxi	Prefecture	202	14.79	134	23.20	209	8.04	180	35.30
Baiyin	Gansu	Prefecture	201	14.81	195	13.04	95	39.93	208	13.61
Zigong	Sichuan	Prefecture	200	15.46	129	23.56	153	29.05	205	15.62
Xiaogan	Hubei	Prefecture	199	15.84	187	14.96	214	3.46	125	50.78
Songyuan	Jilin	Prefecture	198	15.86	202	11.03	211	6.75	122	51.47
Yiyang	Hunan	Prefecture	197	16.06	183	16.31	189	23.26	191	30.18
Zunyi	Guizhou	Prefecture	196	16.51	110	25.12	165	27.79	204	17.99

Notes: UC: Urban Competitiveness; EC: Economic Competitiveness;
SC: Social Competitiveness; GC: Environmental Competitiveness.

The social competitiveness of top cities depends on various conditions of the society. Specifically, high values are found in indicators related to the quality of life, social security, education and training, and urban development in such top cities. In other

words, the social competitiveness of top cities is built on a relatively more comfortable and modern society than other cities, which is supported by better physical infrastructures and services ranging from schools, hospitals, telecommunication and transportation services to culture amenities. The relatively lower unemployment rate and more savings and insurance coverage make the competitiveness of top cities higher.

However, it should be noted that top cities are not perfect on every aspect. Though many top cities are able to provide their urban dwellers spacious green areas because of good planning, few of them are free from environmental problems such as pollution or poor treatment of waste that have downgraded the overall quality of their urban environment. The sewage treatment in Beijing and Guangzhou seems to be inadequate with only 75.45% and 67.81% of industrial sewage discharged meeting the national standard in 1999 (National Bureau of Statistics, 2001). Though the indicator is over 80% in other top cities, much time and effort are still needed to reach the ideal 100% treatment. Clearly, environmental conservation is not progressing at the same pace as economic growth and social development in most Chinese cities. The correlation analysis mentioned above suggests that environmental competitiveness is less consistent with either economic or social competitiveness.

Comparing Single Indicator with Urban Competitiveness Index

Based on 55 economic, social and environmental indicators, a comprehensive index of urban competitiveness is developed in this research. It is interesting to explore whether there is any single indicator that is closely related to the urban competitiveness index with high correlation coefficient. Conventional indicators related to GDP or city size are often considered to have a close relationship with the competitiveness of a city and their relationship with urban competitiveness index is examined in this section.

Conventional indicators related to GDP include GDP, GDP per capita and GDP growth rate. Table 4 presents their correlation coefficients with urban competitiveness indices. It is clear that most correlation coefficients are significant at 0.01 level. However, GDP growth rate has the lowest correlation coefficient with urban competitiveness index and has no significant correlation coefficient with the social and environmental competitiveness indices. This indicates that GDP growth rate cannot indicate urban competitiveness adequately. This is understandable as GDP growth rate is not a stable economic indicator and economic growth alone could not ensure overall urban competitiveness.

Table 4. The Pearson correlation coefficients between competitiveness and GDP indicators.

Indicator	GDP	GDP per capita	GDP growth rate
Urban Competitiveness	0.541*	0.703*	0.203*
Economic Competitiveness	0.694*	0.714*	0.245*
Social Competitiveness	0.448*	0.664*	0.156
Environmental Competitiveness	0.180*	0.323*	0.090

Note: * significant al 0.01 level.

Similarly, GDP and GDP per capita also have low correlation coefficients with environmental competitiveness index although they are significant at 0.01 level. This indicates again that large GDP or GDP per capita could not ensure high environmental competitiveness in all cities.

Overall, GDP per capita has the highest correlation coefficients with urban competitiveness index and its two components, economic and social competitiveness. This means that GDP per capita is a rough indicator of urban competitiveness and is useful for quick reference. However, there is only a weak link between GDP per capita and environmental competitiveness. Thus, the comprehensive index of urban competitiveness developed in this research is preferable to GDP per capita for assessing urban competitiveness.

Conventional indicators related to city size include the total population, non-agricultural population and population density of a city. Table 5 presents their correlation coefficients with urban competitiveness indices and most correlation coefficients are significant at 0.01 level. It is clear that the degree of relationship between three indicators of city size and competitiveness indices was less than those between GDP related indicators and competitiveness indices. No single indicator of city size has a high correlation coefficient, like GDP per capita, with competitiveness indices. Furthermore, the correlation coefficients between the environmental competitiveness and the total population and non-agricultural population of a city are not significant at 0.01 level. This means that the city size has no significant relation with the quality of environment as large cities are not necessarily having high or low environmental competitiveness. In conclusion, it seems that none of the above three conventional indicators of city size is significant enough to indicate the competitiveness of a city.

Table 5. The Pearson correlation coefficient between competitiveness and scale indicators of city.

Indicator	Total population	Non-agricultural population	Population density
Urban Competitiveness	0.302*	0.430*	0.448*
Economic Competitiveness	0.474*	0.548*	0.327*
Social Competitiveness	0.196*	0.368*	0.533*
Environmental Competitiveness	0.071	0.135	0.225*

Note: * significant al 0.01 level.

Conclusion

Urban competitiveness has become an important issue in the modern world in recent years. China is undergoing a transition from a planned economy towards a market economy. Arguably, urban competition in China is not the same as the capitalist cities. The role of urban government is particularly important in Chinese cities. Nevertheless, the Chinese cities may share some common performance and explanatory indicators

with western cities in defining a competitive city. Thus, conceptual and empirical studies on the competitiveness of western cities provide a useful reference for the study in the Chinese context. Further study on the unique process of urban competition in China is required. On-going study on urban governance in China would shed light on this issue.

There has been increasing number of studies on the competitiveness of Chinese cities in the Chinese literature (Ni, 2001; Bianweihui, 2003). But there are problems of selecting appropriate indicators and weighting methods that affect the evaluation results seriously. For example, many city-size related indicators are often used so that the ranking of a city depends very much on the city-size instead of urban competitiveness. This paper attempts to overcome these problems and adopts a better weighting method. It is also probably the first time that the urban competitiveness of as many as 215 cities is assessed systematically using a consistent method.

The paper has evaluated the competitiveness of 215 Chinese cities at prefecture-level in 1999 by using an integrated index, which is based on a three-tier indicator systems consisting of 55 economic, social and environmental indicators. After an evaluation of three weighting methods, the equal weighting method is chosen to measure the urban competitiveness. Although there is no significant difference in the results of three different methods, the limitations of SD and FA methods make EW method a more appropriate weighting method to derive a comprehensive index of urban competitiveness.

The urban competitiveness analysis in this paper shows that Shenzhen, Zhuhai, Shanghai, Beijing and Guangzhou were the most competitive cities in China in 1999. The results of this study are not completely comparable with previous studies due to differences in the indicators, weighting methods and the number of cities covered. For example, the order of top four cities found in this study is different from Ni (2001) whose order was Shanghai, Shenzhen, Guangzhou and Beijing. But it is close to Bianweihui (2003) whose order based on the index of urban development potential was Shenzhen, Shanghai, Beijing and Guangzhou. Zhuhai ranked fifth in that study.

The relationship among the three competitiveness components is revealed by correlation analyses. There was less consistency between environmental competitiveness and economic or social competitiveness. This means that, in some cities, economic or social competitiveness does not necessarily ensure environmental competitiveness.

By examining the values of the competitiveness components, subgroups and indicators used in this study, it is found that the competitive strength of top cities derives from their strong economies, which are supported by large-scale investment, many talents and professionals and an expanding external invested sector. On the other hand, a more comfortable and stable society supported by a wide range of better infrastructure and services contributes to the overall competitiveness of top cities.

However, most cities, even the top cities, are facing acute environmental problems resulted from pollution and inadequate waste treatment. It is clear that the pursuing of rapid growth at the expense of environmental conservation is not a right path towards high competitiveness. Only through overall improvement in economic, social and

environmental aspects, the competitiveness of Chinese cities can really be boosted and sustained.

The paper has also explored whether there is any single indicator related to GDP or city size that is closely related to the urban competitiveness index with high correlation coefficient. It is found that GDP per capita has the highest correlation coefficient with the urban competitiveness index. This means that GDP per capita is a rough indicator of urban competitiveness. However, there is only a weak link between GDP per capita and environmental competitiveness. Thus, the comprehensive index of urban competitiveness developed in this research is preferable to GDP per capita for assessing urban competitiveness.

Footnote

1. In 1999, there were 240 cities at prefecture-level or above in China. However, 25 prefecture-level cities are excluded from this study since their data are not complete or cannot be obtained from any possible sources. All county-level cities are not included as no systematic data are available for such cities. A prefecture-level city refers to only the urban proper and excludes any counties or county-level cities under its administration to minimize the impact of urban administrative structure on various indicators.

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