Chapter 45
China Creative Industry Development Efficiency Assessment

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Abstract This paper builds an input-output assessment index system of creative industry development efficiency according to the characteristics of creative industry. Taking use of the C^2R model, the BC^2 model and super-efficiency DEA model, taking the creative industry in China's 26 major cities for example, we implement the DEA model quantitative empirical assessment to China creative industry's reality development efficiency. The assessment result indicates the industrial characteristics of China creative industry development efficiency as descending stepwise development from coastal areas to inland, while the internal development is extremely uneven. According to the overall efficiency value, this paper divides China's 26 major cities into three echelons from high to low, and points out that it is necessary to build regional different optimization ideas and specific optimization path for the future development of China creative industry.

Keywords Creative industry · Development efficiency · DEA assessment

45.1 Introduction

The boom in the global of Creative industry arouses great concern of scholars from various countries, and a variety of literatures on the assessment of the development of creative industry have emerged. Eysenck [2] argues that the creative industry development assessment indicators consist of cognitive indicators, environmental indicators, personality indicators; Landry [3] proposes the city's creative industry assessment should take into account the economic, social, environmental and cul-

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tural factors; Richard Florida [4] introduces high-tech index, innovation index, creative class index, integrated diversification index as the assessment index system for the development of creative industry, also proposes a widely accepted 3Ts assessment index system, and takes technology, talent and tolerant as the assessment index of creative industry development; international institutions or government also promote related study to creative industry development assessment on the basis of the Florid, such as the UNESCO [6] creative industry development assessment index system consist of human capital, technology development, market demand, administrative agencies and, the Hong Kong Creativity Index 5Cs developed by the Government of Hong Kong [7], Shanghai Urban Creativity Index and so on.

From the overall situation of the above studies at home and abroad, the assessment of creative industry development is more focus on evaluating macro level such as the economic development basis of a country or region, the open degree of society, the efficiency of system operation, cultural and educational, to reflect the level of the creative industry development, lacking the assessment to development status decided by development mechanism of creative industry from the meso level. From the perspective of the creative industry development mechanism, the process of industry value creation, is the input process of creative industry input factors such as human capital, cultural capital, institutional capital, marketing capital and other [1], While the achievement of the creative industry value, is thus the economic and social benefits brought by creative industry through the input of production elements. The input process and output results of production elements, together determine the efficiency of creative industry development. Based on the above argument, this paper establishes creative industry input factors assessment index and output assessment index, following with an empirical study of the creative industry development efficiency in China based on DEA model.

45.2 The Content of Creative Industry Development Efficiency Assessment Index

45.2.1 Input Factors index

This paper argues that, input factors index of the creative industry development efficiency assessment, mainly refers to concrete input factors index in the creative industry value creation process, including indicators of human capital, cultural capital, institutional capital, marketing capital.

(1) Human capital index

• The proportion college students account for the local population.

Creative industry takes creative production as the core, creative talent is the inexhaustible source of creative production and the aggregate of producers of high-quality creative, so it is core production inputs of creative industry, and high-quality college students often is a concentrated expression of creative talent and even the

level of human capital. Therefore, we believe that the greater proportion of college students means the higher stock and quality of regional human capital, the more prominent creative ability, and the higher human capital input-output efficiency.

• The proportion R&D expenditure accounts for local GDP.

The proportion R&D expenditure accounts for local GDP, reflects the support efforts of local government and creative enterprises to create a good creative talents environment, thereby affecting the human capital accumulation of the local creative industry. Those R&D funds commensurate with the extent of local economic development and needs of the creative industry development, through the interaction between the high capital investment, the introduction of technical staff and high-quality creative research, translates into the local human capital advantage, thus it is an important form of local human capital accumulation and investment, reflecting not only the development potential of creative industry in the region, but also the local creative industry development status.

• The number of research institutions.

Research institutions act as the basic birthplace of creative originality and integration, from which a large number of creative industry theoretical study talent, practical design and technical personnel come, therefore it is also an important input factor of high value-added content creation, marketing aspects. The number of research institutions, reflecting acquisition cost of creative industry talent and market-oriented level of using human capital, is an important element of the human capital investment in the process of creative industry development.

(2) Cultural capital index

• The number of public library books per 100 persons.

The number of books in public libraries is an important form of cultural capital accumulation in a national or regional development of creative industry, with an important impact on the high value-added development of creative industry chain. This paper use the number of public library books per 100 persons to measure this form of culture capital accumulation.

• The proportion foreign population accounts for the local population.

The proportion foreign population accounts for the local population, reflects the extent of local culture tolerance and cultural diversity in a way, also indirectly reflects regional level of capital investment. A greater foreign population percentage in a region means greater cultural diversity stronger culture attraction and creative force. Therefore creative talent with different cultural backgrounds, customs and habits will flow to the region. The integration of migrants and the local population promotes exchange of different culture and technology, and the generation of new ideas and knowledge, and the formation of a powerful cultural capital advantage. Therefore, this paper uses the proportion foreign population accounts for the local population in a period of time as an important measure of creative industry cultural capital investment.

• The proportion household cultural consumption expenditures accounts for total consumption expenditure.

The proportion household cultural consumption expenditures accounts for total consumption expenditure, on one hand, reflects the real purchasing power of the

modern residents cultural consumption demand, measures modern residents' cultural capital expenditure level; on the other hand, it is able to some extent to reflect the local residents culture consumption propensity and cultural capital expenditure potential, which together reflect the stock size and investment level of local culture capital.

(3) The institutional capital index

• The number of creative industry cluster.

The creative industry cluster is characterized by the combination of life and work, combination of knowledge and cultural production and consumption, combined of the diverse relaxed environment and unique local characteristics, to achieve the above combination, it needs government to guide the formation and development of creative industry cluster from the perspective of macro institution [5]. Government provides tax relief, investment and financing policies, access system, industry public information service platform and other system-level support, thereby reduces the cost of park creative enterprises that, to ensure the normal operation and development of the creative industry cluster. Based on this, this paper takes number of creative industry cluster as an important measure government institutional capital investment to creative industry, in order to reflect the size and scale of the institutional capital investment.

• The proportion government fiscal expenditure on cultural undertakings accounts for total expenditures.

Creative industry originated in the cultural industry, the development and utilization of cultural capital is important for the development of creative industry, the input-output cycle of cultural capital is long, often along with unexpected high risk. The proportion government fiscal expenditure on cultural undertakings accounts for total expenditures, institutionally reflects the degree of local government's attention to cultural capital, human capital accumulation, also constitute an important form of institutional capital investment to creative industry.

(4) Marketing capital index

• The number of culture and arts intermediary institutions.

The brokers, planners, designers and other creative people in cultural and artistic institutions, although are not direct producers of creative products, but they are the direct links and feedback channels between creative product and market, they are important form of creative industry marketing capitalplaying a key intermediary role as a bridge. Therefore, we believe that a more reasonable number of culture and arts intermediaries, means more full use creative industry marketing capital, and their creative products will be more close to the market demand, the real development of the creative industry may be the better.

• The number of households which use Internet.

Under the conditions of modern information society, the Internet is not only a major information dissemination media of marketing creative aspects, but also produces added value in the form of marketing capital investment. In the Internet age, any creative product information can be rapidly presented to consumers through marketing capital investment, thus it greatly reduces consumer's search costs and time costs for creative products, and enhances the effectiveness that creative prod-

ucts reach the consumer, achieves the "long tail" marketing of the creative product and benign and efficient cycle of creative industry chain value creation. Therefore, the paper argues that the number of households which use Internet is an important part of the creative industry marketing capital, and the number of national or regional households which use Internet, has a direct impact on the possibility of realizing the value of creative products and the overall value-added effect of creative industry.

45.2.2 Output Factors Index

Output factors index of creative industry development efficiency assessment, refers to concrete manifestation of creative industry value realization, including the assessment index of economic benefits and social benefits of creative industry.

(1) Economic benefits index

• The number of patents.

The patents owned by a country or region is an external manifestation of the creative knowledge and thinking, is a kind of high-value creative intellectual property after putting in a lot of human capital, cultural capital, and other production elements. This kind of intellectual property is protected by the patent laws, provides the basis of core competitiveness for local creative enterprises production, making it different from similar enterprises, to some extent represents the output capacity and economic size of regional creative industry. Therefore, this paper argues that more number of patents a country or region has, its competitive advantage for creative production may be the greater, and output results under its human capital, cultural capital, and other creative industry production inputs may be better, the economic benefits of creative enterprise is likely to be greater.

• The creative industry added value.

The creative industry added value reflects the scale of creative industry development, is the most direct expression of the creative industry economic benefits. The whole creative industry chain, including creative content, production and manufacturing, creative marketing, consumption, takes the maximization of creative industry added value as an immediate purpose. Economic benefit is eternal primary pursuit of creative industry. Only when creative industry chain can create enough added value for the normal operation, the pursuit for economic benefits can be achieved, enhancing the ability of creative industry to achieve sustainable value. Therefore, we believe that the greater creative industry added value directly means the higher level of economic benefits of creative industry, the greater ability to create and realize value and the better development of creative industry.

(2) Social benefits index

The creative industry employment. Employment absorbed in the creative industry is direct manifestations of the social benefits of the of creative industry development, It needs to employ persons to participate in creative content, manufacturing, marketing and other creative industry value chain. There are at least two aspects the

social benefits embodied in creative industry employment increase: on one hand, the increasing creative industry employment relieves the employment pressure of whole society, and improves residents' income level, in favor of social harmony and stability; on the other hand, with the increase of creative industry employment, social creative atmosphere is enhanced to be able to promote the industry and technical innovation, in favor of economic development mode shift, to improve the overall effectiveness of economic development. Therefore, the creative industry employment is taken as an important indicator to assess the social benefits of creative industry in a country or region, the more creative industry employment means the greater development for local creative industry and even economic and the greater social benefits.

45.3 Selection of the Decision-making Unit and the DEA Model Assessment Index System

According to the above analysis to creative industry development mechanismfactors that influence creative industry development efficiency, and assessment index system based the factors, this paper selects 26 China cities namely Beijing, Tianjin, Qingdao, Jinan, Harbin, Shanghai, Nanjing, Hangzhou, Suzhou, Ningbo, Shijiazhuang, Taiyuan, Zhengzhou, Wuhan, Changsha, Chongqing, Chengdu, Xi'an, Nanning, Kunming, Guangzhou, Shenzhen, Wuxi, Xiamen, Fuzhou, Hefei as the decision-making unit (DMU) of China's creative industry development efficiency assessment. The 10 input factors index include: the proportion college students account for the local population, the proportion R&D expenditure accounts for local GDP, the number of research institutions, the number of public library books per 100 persons, the proportion foreign population accounts for the local population, the proportion household cultural consumption expenditures accounts for total consumption expenditure, the number of creative industry cluster, the proportion government fiscal expenditure on cultural undertakings accounts for total expenditures, the number of culture and arts intermediary institutions, the number of households which use Internet. The 3 output factors index include: the number of patents, the creative industry added value, the creative industry employment. Thus we establish a DEA model assessment index system, its structure in details is shown in Table 45.1.

According to the above DEA model assessment index system for China creative industry development, we mainly collect data for assessment through the industry reports, statistical yearbooks, site search and other ways. Considering accessibility and comparability of the data, we use input-output data of the above 26 major cities' creative industry development in 2008. It should be noted that: the measurement unit of the proportion college students account for the local population, the proportion R&D expenditure accounts for local GDP, the proportion foreign population accounts for the local population, the proportion household cultural consumption expenditures accounts for total consumption expenditure, the proportion

government fiscal expenditure on cultural undertakings accounts for total expenditures is (%),the measurement unit of the number of households which use Internet is (10,000 households), all index value keeps two decimal places after rounding off.

Table 45.1 DEA model assessment index system for China creative industry development

Input factors index (X)	The proportion college students account for the local population (X_1)
	The proportion R&D expenditure accounts for local GDP (X_2)
	The number of research institutions (X_3)
	The number of public library books per 100 persons (X_4)
	The proportion foreign population accounts for the local population (X_5)
	The proportion household cultural consumption expenditures accounts for total consumption expenditure (X_6)
	The number of creative industry cluster (X_7)
	The proportion government fiscal expenditure on cultural undertakings accounts for total expenditures (X_8)
	The number of culture and arts intermediary institutions (X_9)
	The number of households which use Internet (X_{10})
Input factors index (Y)	The number of patents (Y_1)
	The creative industry added value (Y_2)
	The creative industry employment (Y_3)

45.4 DEA Model Calculation

In order to make an objective and accurate assessment of China's major cities creative industry development efficiency status, the empirical assessment analysis of 26 DMUs such as Beijing, Shanghai etc. is divided into three steps: the first step is, through the traditional C^2R model, to obtain the overall efficiency value, optimal index weight coefficient value and slack variable value of all DMUs; the second step is, through BC^2 model, to obtain the pure technical efficiency value of DMU, in order to get scale efficiency value of the assessment unit; the third step is, through the super-efficiency DEA model, to obtain a second set of overall efficiency value, in order to provide the necessary data to support further sort analysis.

45.4.1 C^2R Model Calculation

In order to make a comparative assessment of the overall efficiency and scale efficiency of 26 DMUs, according to the C^2R model, we execute optimization calculation with China creative industry development data, we get the overall efficiency value θ, input-output index weight coefficient value λ and slack variable values s^+, s^- of all the 26 DMUs. The results are shown in Tables 45.2 $\sim$ 45.4.

Table 45.2 C^2R model assessment results of China creative industry development efficiency-1

Value	DMU								
	Beijing	Tianjin	Qingdao	Jinan	Harbin	Shanghai	Nanjing	Hangzhou	Suzhou
s_1^-	0.000	0.000	0.000	6.431	0.000	0.000	3.366	0.000	0.000
s_2^-	0.000	0.347	0.000	0.801	0.428	0.000	0.372	0.000	0.000
s_3^-	0.000	141.684	0.000	121.514	97.095	0.000	122.095	0.000	0.000
s_4^-	0.000	0.000	45.138	0.000	0.000	0.000	0.000	0.000	0.000
s_5^-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s_6^-	0.000	0.000	8.117	2.266	0.000	0.000	0.000	0.000	6.687
s_7^-	0.000	0.000	0.592	0.000	0.000	0.000	0.000	0.000	0.000
s_8^-	0.000	0.000	0.000	10.635	3.509	0.000	0.000	0.000	0.000
s_9^-	0.000	0.000	0.000	18.017	23.367	0.000	39.640	0.000	0.000
s_{10}^-	0.000	216.182	0.000	13.540	6.816	0.000	0.000	0.000	0.000
s_1^+	0.000	0.000	0.000	0.000	0.000	0.000	0.289	0.000	0.000
s_2^+	0.000	0.000	0.000	0.017	0.012	0.000	0.000	0.000	0.000
s_3^+	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$\Sigma_{j=1}^n \lambda_j$	1.000	0.745	1.000	0.281	0.334	1.000	0.650	1.000	1.000
θ	1.000	0.811	1.000	0.786	0.451	1.000	0.863	1.000	1.000

45.4.2 C^2R Model Calculation

C^2R Assessment model can only be used for the assessment to overall efficiency and returns to scale of DMU. However, some DMUs are overall non-DEA efficient, they are scale inefficient, but they are still pure technical efficient. Therefore, in order for all-round, multi-level analysis to creative industry development efficiency in China's 26 major cities, we introduce the BC^2 model into empirical assessment analysis. The pure technical efficiency value θ^p of 26 DMUs is shown in Table 45.5.

Table 45.3 C^2R model assessment results of China creative industry development efficiency-2

Value	DMU								
	Ningbo	Shijiazhuang	Taiyuan	ZhengZhou	Wuhan	Changsha	Chongqing	Chengdu	Xi'an
s_1^-	0.000	0.000	5.846	2.682	0.000	0.000	0.000	0.000	4.582
s_2^-	0.000	0.000	1.161	1.820	0.000	0.000	0.000	0.000	2.746
s_3^-	0.000	0.000	27.248	26.289	0.000	0.000	0.000	0.000	280.111
s_4^-	0.000	0.000	45.138	0.000	0.000	0.000	0.000	0.000	0.000
s_5^-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s_6^-	0.000	0.000	8.117	2.266	0.000	0.000	0.000	0.000	6.687
s_7^-	0.000	0.000	0.592	0.000	0.000	0.000	0.000	0.000	0.000
s_8^-	0.000	0.000	13.334	4.972	0.000	0.000	0.000	0.000	6.739
s_9^-	0.000	0.000	8.717	0.000	0.000	0.000	0.000	0.000	0.000
s_{10}^-	0.000	0.000	0.000	18.701	0.000	0.000	0.000	0.000	5.794
s_1^+	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s_2^+	0.000	0.000	0.000	0.029	0.000	0.000	0.000	0.000	0.039
s_3^+	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
$\Sigma_{j=1}^n \lambda_j$	1.000	1.000	0.083	0.423	1.000	1.000	1.000	1.000	0.469
θ	1.000	1.000	0.675	0.625	1.000	1.000	1.000	1.000	0.844

Table 45.4 C^2R model assessment results of China creative industry development efficiency-3

Value	DMU							
	Nanning	Kunming	Guangzhou	Shenzhen	Wuxi	Xiamen	Fuzhou	Hefei
s_1^-	1.875	0.000	0.000	0.000	0.527	0.000	0.000	3.333
s_2^-	0.000	0.000	0.000	0.000	0.906	0.000	0.000	0.938
s_3^-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	69.931
s_4^-	7.658	0.000	0.000	0.000	0.000	0.000	0.000	26.505
s_5^-	8.894	0.000	0.000	0.000	8.341	0.000	0.000	0.000
s_6^-	7.699	0.000	0.000	0.000	2.826	0.000	0.000	7.405
s_7^-	1.684	0.000	0.000	0.000	1.488	0.000	0.000	0.005
s_8^-	8.943	0.000	0.000	0.000	5.397	0.000	0.000	6.974
s_9^-	22.541	0.000	0.000	0.000	0.000	0.000	0.000	6.646
s_{10}^-	0.000	0.000	0.000	0.000	9.199	0.000	0.000	0.000
s_1^+	2.514	0.000	0.000	0.000	2.043	0.000	0.000	0.000
s_2^+	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
s_3^+	0.002	0.000	0.000	0.000	0.005	0.000	0.000	0.001
$\Sigma_{j=1}^n \lambda_j$	0.271	1.000	1.000	1.000	0.478	1.000	1.000	0.101
θ	0.895	1.000	1.000	1.000	0.832	1.000	1.000	0.629

45.4.3 Super-efficiency DEA Model Calculation

From Tables 45.2 $\sim$ 45.5, we can see that the traditional C^2R model and BC^2 model cannot solve the specific sort problem of DMU, we need make partial improvement for traditional C^2R model, to get a more accurate solution to the sort difficult of effective DMU, in order to make a more detailed analysis to creative industry devel-

Table 45.5 BC^2 model assessment results of China creative industry development pure technical efficiency

DMU	Beijing	Tianjin	Qingdao	Jinan	Harbin	Shanghai	Nanjing
θ^p	1.000	0.848	1.000	1.000	0.625	1.000	1.000
DMU	Hangzhou	Suzhou	Ningbo	Shijiazhuang	Taiyuan	Zhengzhou	Wuhan
θ^p	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DMU	Changsha	Chongqing	Chengdu	Xi'an	Nanning	Kunming	Guangzhou
θ^p	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DMU	Shenzhen	Wuxi	Xiamen	Fuzhou	Hefei	average	
θ^p	1.000	1.000	1.000	1.000	1.000	0.980	

opment status in China's major cities. Thus we introduce the super-efficiency DEA model.

We take super-efficiency DEA model calculation with input-output data of the 26 DMUs, to get optimal efficiency value θ^s under the super-efficiency DEA model. The results are shown in Table 45.6.

Table 45.6 Super-efficiency DEA model assessment results of China creative industry development overall efficiency

DMU	Beijing	Tianjin	Qingdao	Jinan	Harbin	Shanghai	Nanjing
θ^s	2.471	0.811	1.862	0.786	0.451	2.098	0.863
DMU	Hangzhou	Suzhou	Ningbo	Shijiazhuang	Taiyuan	Zhengzhou	Wuhan
θ^s	2.236	2.719	1.188	1.047	0.675	0.625	1.116
DMU	Changsha	Chongqing	Chengdu	Xi'an	Nanning	Kunming	Guangzhou
θ^s	2.068	1.699	1.357	0.844	0.895	1.757	1.191
DMU	Shenzhen	Wuxi	Xiamen	Fuzhou	Hefei	average	
θ^s	1.553	0.832	1.151	1.324	0.629	1.317	

45.5 Results Assessment and Analysis

45.5.1 The Assessment of DMU's Overall Efficiency

The description of the overall efficiency value is the overall operating efficiency status of DMU on the basis of constant returns to scale. As shown in Tables 45.2 ∼ 45.4, from the perspective of overall efficiency of China's 26 major cities creative industry development, 16 cities namely Beijing, Qingdao, Shanghai, Hangzhou, Suzhou, Ningbo, Shijiazhuang, Wuhan, Changsha, Chongqing, Chengdu, Kunming, Guangzhou, Shenzhen, Xiamen, Fuzhou are DEA efficient units. 10 cities namely Tianjin, Jinan, Harbin, Nanjing, Taiyuan, Zhengzhou, Xi'an, Nanning, Wuxi, Hefei are non-DEA efficient units. Among 10 non-DEA effective units, Nanning is closest to effective production frontier which consists of efficient DEA units; its overall efficiency value reaches 0.895. Harbin, whose value is 0.451, is farthest away from the efficient production frontier. The overall efficiency value of majority of non-DEA efficient units is between 0.600 and 0.900, while the average efficiency value of 26 cities is 0.900. Therefore, from the overall point of view, the development of creative industry in China remain at a relatively high level of efficiency, which is the reason why China creative industry bucked the trend, leading the national economy maintaining steady and rapid growth.

From the view of the characteristics of the creative industry development overall efficiency, Beijing and Shanghai is the most developed areas in economy and culture in China. Guangzhou, Shenzhen is the most rapid economic development forefront after China's reform and opening up. In China's middle-western economic and cultural center, Wuhan, Changsha, Chongqing, Chengdu, the development of the creative industry is also DEA efficient. In China's middle-western regions with relatively poor economic development, Hefei, Nanning, Zhengzhou, Taiyuan, Xi'an although have rich historical and cultural resources to support the creative industry development, but compared to those DEA efficient cities, their creative industry development are obviously at a disadvantage.

The above results also indirectly reflect that the established assessment index system in this paper can appropriately reflect creative industry development relies on cultural resources and market-oriented characteristics. The results of assessment model can appropriately reflect China's regional economic development status and the reality of the regional creative industry development.

45.5.2 The Assessment of DMU's Technical Efficiency

Different from the overall efficiency value, the technical efficiency value of DMU shows, on the basis of variable returns to scale, the DMU's under given input factors. From the pure technical efficiency values of China's 26 major cities shown in Table 45.5, in addition to the 16 cities which are overall DEA efficient, 8 overall non-

DEA efficient cities namely Jinan, Nanjing, Taiyuan, Zhengzhou, Xi'an, Nanning, Wuxi, Hefei have pure technical efficiency value of 1.000, only Tianjin and Harbin's pure technical efficiency value is less than 1.000, Harbin's pure technical efficiency values is as low as 0.625, indicating that under given input factors, compared with the other 24 cities, Tianjin and Harbin's creative industry technical output capacity is relatively low and need to be further improved. Overall, the 26 cities' average pure efficiency value reaches 0.980, indicating that the development of China major cities' creative industry, is basically in a purely technical efficient production frontier surface, also verifying the SMEs as the main force of China creative industry development, have relatively strong technological innovation capability, integration capability and application capability. High technical efficiency value is also the main driver to support the high overall efficiency value of China major cities.

45.5.3 The Assessment of DMU's Scale Efficiency

DMU's scale efficiency is the largest marginal product brought by a unit of input factors under the same technical and other conditions. According to the principle of DEA model, we can directly calculate the scale efficiency value of each DMU through the formula $\theta^g = \theta/\theta^p$. Therefore, with Tables 45.2 $\sim$ 45.5, we calculate the scale efficiency value of creative industry development of China's 26 major cities; the results are shown in Table 45.7.

Table 45.7 Assessment of China creative industry development scale efficiency

DMU	Beijing	Tianjin	Qingdao	Jinan	Harbin	Shanghai	Nanjing
θ^g	1.000	0.957	1.000	0.786	0.721	1.000	0.863
DMU	Hangzhou	Suzhou	Ningbo	Shijiazhuang	Taiyuan	Zhengzhou	Wuhan
θ^g	1.000	1.000	1.000	1.000	0.675	0.625	1.000
DMU	Changsha	Chongqing	Chengdu	Xi'an	Nanning	Kunming	Guangzhou
$\theta^g s$	1.000	1.000	1.000	0.844	0.895	1.000	1.000
DMU	Shenzhen	Wuxi	Xiamen	Fuzhou	Hefei	average	
$\theta^g s$	1.000	0.832	1.000	1.000	0.629	0.916	

From Table 45.7, we can see that in the 16 cities which are overall DEA efficient, scale efficiency value is 1.000, representing a relatively high level of scale development, indicating that in the 16 cities, the marginal output capacity of creative industry production factors is strong, input quality of input factors is high, overall achieving efficient use. It can be seen at the same time, that the 10 overall non-DEA efficient cities such as Tianjin, Jinan and Harbin etc. remain a certain distance away

from the scale efficiency production frontier, among them Zhengzhou has the lowest scale efficiency value 0.625, marginal production capacity of creative industry input factors is relatively insufficient. The average scale efficiency value of 26 cities is 0.916, indicating that the degree of marginal utilization of China's creative industry input factors is overall at a high level, but it remains a big gap compared with the pure technical efficiency value of 0.980, reflecting a certain blindness of the current development of China creative industry, the overemphasis to the amount of inputs factors, the neglect of improvement on its structure and quality, and the insufficiency of efficient utilization to production factors, leading to the marginal productivity of input factors lags far behind the industry technical development. The input structure and quality of production factors need to be improved urgently.

In terms of China creative industry's returns to scale, it can be reflected by the sum of index weight coefficient $\Sigma_{j=1}^{n}\lambda_j$. From Table 45.5, the $\Sigma_{j=1}^{n}\lambda_j$ of 26 overall DEA efficient DMUs is 1.000, representing the constant returns to scale, indicating a high returns to scale and mature development direction of the city's creative industry. Tianjin, Jinan, Harbin and other 7 non-DEA efficient DMUs' $\Sigma_{j=1}^{n}\lambda_j$ are less than 1.000; they are in the stage of increasing returns to scale. The average $\Sigma_{j=1}^{n}\lambda_j$ of the 10 non-DEA effective DMUs is 0.382, returns to scale is at relatively low level. This fully proves the creative industry development characteristics represented by china SMEs, the utilization to input factors remains at a relatively low level, the scale output capacity has a large potential for development, showing increasing trends of returns to scale. With the development of creative industry, the output proportion of creative industry is much greater than input proportion, thus promoting China's economic structural adjustment, achieving the transformation to creative economy, and maintaining a good and fast economic development.

45.5.4 Sort of DMU Overall Efficiency

The traditional C^2R model, BC^2 model cannot further sort overall DEA efficient DMUs, super-efficiency DEA model is a good solution to this problem. We get the second group overall efficiency value through super-efficiency DEA model calculation, as shown in Table 45.4. We can see the overall descending order of China's 26 major cities creative industry development is Suzhou, Beijing, Hangzhou, Shanghai, Changsha, Qingdao, Kunming, Chongqing, Shenzhen, Chengdu, Fuzhou, Guangzhou, Ningbo, Xiamen, Wuhan, Shijiazhuang, Nanning, Nanjing, Xi'an, Wuxi, Tianjin, Jinan, Taiyuan, Hefei, Zhengzhou, Harbin. Under the super-efficiency DEA model, the average overall efficiency value of 26 cities is 1.317, at relatively high efficiency level.

From specific classification and individual analysis of the above sort, we can clearly see in the Fig. 45.1 that, 5 cities namely Suzhou, Beijing, Hangzhou, Shanghai, Changsha are the first echelon of the creative industry development in China, their overall efficiency values are all more than 2.000, while the highest overall efficiency value is 2.719 for Suzhou; 11 cities namely Qingdao, Kunming, Chongqing,

Shenzhen, Chengdu, Fuzhou, Guangzhou, Ningbo, Xiamen, Wuhan, Shijiazhuang are the second echelon, while their overall efficiency values are between 1.000-2.000; 10 cities namely Nanning, Nanjing, Xi'an, Wuxi, Tianjin, Jinan, Taiyuan, Hefei, Zhengzhou, Harbin are the third echelon, their overall efficiency values are all lower than 1.000, while the overall efficiency of Harbin value is even only 0.451. From the three echelons classification, we can see that China major cities in the creative industry development shows extreme imbalance, the highest overall efficiency value (Suzhou) is 6.03 times as the lowest overall efficiency value (Harbin), there is a huge gap between the coastal and inland, which is basically consistent with the overall status of regional economic and cultural development, also indicating performance of assessment index system in the DEA model is relatively good.

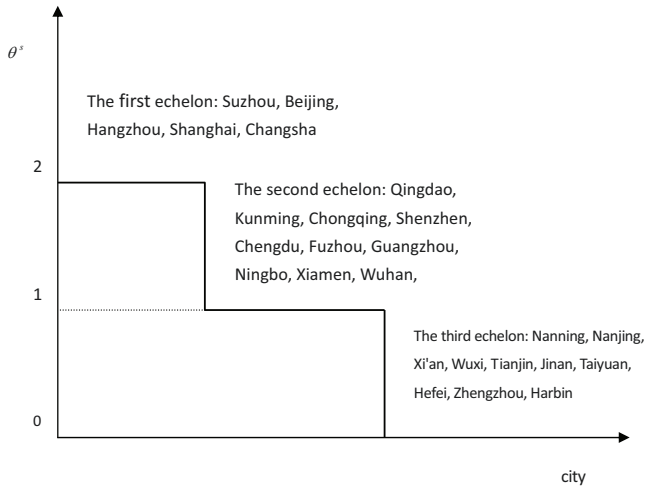

Fig. 45.1 Echelons of China's 26 major cities in the development of creative industry

45.6 Conclusion

The paper identify the assessment unit of China creative industry development efficiency and the DEA model assessment index system, on the basis of data collected for the assessment index, use C^2R model, BC^2 model and super-efficiency DEA model, take an empirical assessment to the China creative industry development efficiency, the assessment results properly reflect the status of creative industry development in China. China creative industry development efficiency basically shows the stepwise development between the coastal and inland, but internal development is extremely unbalanced. According to the efficiency sort of 26 cities in the creative industry development, this paper divided them into three echelons, the first echelon

namely Suzhou, Beijing, Hangzhou, Shanghai, Changsha have the highest level of development efficiency in creative industry; the second echelon including 11 cities such as Qingdao, Kunming, Chongqing, Shenzhen, have a relatively high level of development efficiency; the third echelon including 10 cities such as Nanning, Nanjing, Xi'an, Wuxi, have a relatively low level of development efficiency. Based on the above conclusions, China should be on the basis of regional development status of creative industry, focused on improving the structure and quality of the input factors thereby increasing the level of output, build the regional different optimization ideas and specific optimization path for the future development of China creative industry.

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