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China's economic development stage and its spatio-temporal evolution:
A prefectural-level analysis

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Abstract: As important mechanisms of regional strategy and policy, prefecture-level regions have played an increasingly significant role in the development of China's economy. However, little research has grasped the essence of the economic development stage and the spatio-temporal evolution process at the prefecture level; this may lead to biased policies and their ineffective implementations. Based on Chenery's economic development theory, this paper identifies China's economic development stages at both national and prefectural levels. Both the Global Moran I index and the Getis–Ord Gi* index are employed to investigate the spatio-temporal evolution of China's economic development from 1990 to 2010. Major conclusions can be drawn as follows. (1) China's economic development is generally in the state of agglomeration. It entered the Primary Production Stage in 1990, and the Middle Industrialized Stage in 2010, with a 'balanced–unbalanced–gradually rebalanced' pattern in the process. (2) China's rapid economic growth experienced a spatial shift from the coastal areas to the the inland areas. Most advanced cities in mid-western China can be roughly categorized into regional hub cities and resource-dependent cities. (3) Hot spots in China's economy moved northward and westward. The interactions between cities and prefectures became weaker in Eastern China, while cities and prefectures in Central and Western China were still at the stage of individual development, with limited effect on the surrounding cities. (4) While the overall growth rate of China's economy has gradually slowed down during the past two decades, the growth rate of cities and prefectures in Central and Western China was much faster than those in coastal areas. (5) Areas rich in resources, such as Xinjiang and Inner Mongolia, have become the new hot spots of economic growth in recent years. For these regions, however, more attention needs to be paid to their unbalanced industrial structures and the lagging social development against the backdrop of the rapid economic growth, driven predominantly by the exploitation of resources.

Keywords: economic development stage; spatial pattern; spatio-temporal evolution; prefectural-level regions

1 Introduction

Understanding of the features and regular patterns of the stages of economic development is

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the scientific basis on which state economic development strategies are formulated, and also the major area of economic theory research (Liang *et al*., 2009). While it attracts persistent and wide-ranging attention from academic economists worldwide, geographers are more concerned about research in the area of regional disparities at different stages of economic development, which is an important theme with respect to regional coordinated development and the basis for mapping out development strategies at the national level as well as for regional policies (Fan *et al*., 2010). In particular, for China, the next 10 years will be a critical period for facilitating and implementing regionally coordinated development, so an overall regional development strategy with more specific regional orientations is of urgent need (Liu *et al*., 2011). Therefore, it is very important, both theoretically and practically, to re-assess and determine the national economic development stage, to gain a thorough understanding of the essential characteristics of the Chinese economy, and to explore the developing patterns of its spatial evolution. This paper primarily focuses on two inter-related issues; namely, the assessment and determination of the economic development stages and the exploration of spatial evolution patterns.

Research on the economic development stage dates back to the 1920s, with economists Rostow (1960), Chenery *et al*. (1986), Hoffman (1958), Kuznets (1989), Northam (1979) and Friedmann (1966) taking the lead in exploring the division of different economic development stages from different angles. Although these various dividing methods were based on varied theories and views, they were quite enlightening and influential in explaining the universal evolution rule of the stages of economic development. Domestic scholars have studied and learned from the theories of western economics to begin a widespread investigation of the divisional criteria for Chinese economic development since the 1980s, and all the ongoing disputes can boil down to disagreements on structuralism, totalism and synthetism (Chen *et al*., 2005). The most frequently used theories remain to be those created by Hoffman, Chenery, Rostow, Kuznets and so on, but some researchers established index systems based on different viewpoints and mathematical models to develop a comprehensive evaluation and division of the Chinese economy (Fu *et al*., 2008; Li *et al*., 2000), while others came up with their own comprehensive evaluation to give an overall understanding of the primary features of Chinese economic development (Shen, 1996; Li, 2007). All of these disputes and controversies were well grounded, despite all the differences they displayed. However, the synthetism model for the division of economic development stages lacks, overall, a general objective standard, and has not been subjected to a significant number of practical tests, which weakens its significance for comparative studies, both horizontally and vertically, and for the formulation and implementation of policies. Cheney's standard model, based on structuralism and totalism studies, gives some insight into establishing, objectively, a quantitative relationship between per capita GDP and the economic development stage. The relevant case studies have mainly been at national and provincial levels, but some of them have not taken purchasing power parity into consideration, which undermines the scientific value of their findings (Fu *et al*., 2008).

The evolution of the spatial patterns of regional development has long been a major concern for economic geographers. Since reform and opening up in the late 1970s, China has established and implemented a series of regional development strategies, namely, the unbalanced regional development strategies of Coastal–Inland, three Great Regions, seven

Macro-Economic Regions and four Major Economic Plates, with subsequent strategies including the Great Development of Western China, the Revitalization of the Old Industrial Base in Northeast China, the Rise of Central China and Encouraging the Leading Development of Eastern China. Consequently, great changes have taken place in the spatial patterns of China's regional development, which have attracted the attention of a wide range of researchers and continuous nationwide discussion. Previous research has explored issues at the national scale concerning the changing trend of China's regional disparities (Xu *et al*., 2006), regional interaction and economic growth (Pan, 2012), spatial correlation and regional economic convergence (Zhang *et al*., 2008), and the trend towards economic spatial polarization (Guo, 2004). Meanwhile, problems at the regional and provincial scales, such as the dynamically unbalanced spatio-temporal state of the regional economy (Liu *et al*., 2004), the dynamic of provincial disparity (Xu *et al*., 2005), regional economic connection and the driving forces of regional economic development (Shi *et al*., 2006), and the pattern of growth and differentiation in the regional economy, have also been investigated (Qu *et al.*, 2006). Furthermore, some researchers have conducted detailed studies on the polarization of the regional economy, spatial differentiation and the driving forces of economic growth, and the economic divergence of specific regions such as the northeast, the southeast coastal area and the Huaihai Economic Zone (Li *et al*., 2008; Wu *et al*., 2008; Sun *et al*., 2009). In recent years, it has also been quite common to find detailed investigations, with the prefecture and the province being the evaluation units, including the convergence and disparity of economic growth in Shandong (Zhang, 2010), the spatial polarization of Guangdong (Zhen *et al*., 2000), the evolution of regional economic patterns in Jiangsu (Jin *et al*., 2009) and the shifting of the economic centre of gravity in Fujian (Wang *et al*., 2011). In addition, some researchers have undertaken some profound and detailed analyses concerning the evolution of regional economic development patterns from specific perspectives, such as the effect of transportation constraints on the distribution characteristics of regional economies (Jiang *et al*., 2010), the growth law from the perspective of poverty (Sui *et al*., 2010), the increasing urbanization of inland regions nationally, and its explanation (Cao *et al*., 2011) and the analysis of factors driving growth at the municipal scale (Li *et al.*, 2008). In general, it seems that earlier studies were mostly focused on the Three Great Regions and Coastal–Inland sub-areas, and hence are likely to be lacking in more micro-level insight into, and understanding of, the effects, at the prefectural and provincial levels, of the overall national development stage. Against this backdrop, this paper tries to describe in detail the economic development level and the characteristics of different economic development stages by utilizing the techniques and methodological systems of spatial analysis to analyze the prefectural data pool of the last 20 years. By combining the strengths of macroscopic and microscopic research to assess the spatial pattern of China's economic development, this thesis attempts to enrich existing empirical research and to provide some practical advice for the formulation of regional development strategies.

2 Research scope and the assessment criteria

2.1 Research scope

In the 20 years after the founding of the People's Republic of China (PRC), the regional dis-

tribution of state investment was almost the only determinant in shaping the spatial pattern of Chinese economic development (Lu, 2006), while the major concern of state policy was focussed on the decision-making process at national and regional levels. The Chinese economy entered a new developmental stage marked by the implementation of reform and the opening-up policy in the late 1970s. As a consequence, it was transformed by the reform of the economic system and with the orientation of urban renovation from 1985 to 1991, since which time cities have been the basis and main implementation mechanism of regional strategies. In particular, prefectures, as the regional administrative unit, have played an increasingly significant role in China's economy and in regional coordinated development since the reform of the regional administrative division in 1983. It is not surprising that prefectures have gradually become a major spatial targeting unit for the implementation of national and regional development policies. Moreover, the focus of state policies has shifted from emphasis on macro-level regional development to more micro-level regional reform, and state strategies, taking major cities as nodes, are playing a more and more important part in the whole process.

However, there are few empirical studies in the literature concerning Chinese economic development stages at the regional scale, partly due to different statistical definitions and inconsistent spatial measures, and the limited availability of relevant data. Lack of accurate judgment of development stages at the regional administrative district scale will lead to a high probability of developing regional strategies and policies that are too general, as well as a failure to guide regional development effectively. With the rapid development of prefectures as the regional administrative units in China, it is urgent for researchers to explore and evaluate in detail all the relevant issues at the micro- rather than the macro-level. It has been 20 years since the urbanization innovation, which indicates that the urban administrative system tends to restore its equilibrium at the time being on the one hand, and the related statistic data is getting better all the while on the other, which means that the middle- or long-term research need is going to be perfectly met.

2.2 Assessing the economic development stages

Economic development is a hugely complex, gigantic system, which requires as few and as simple a set of measurement indices as possible to carry out its stage division, while at the same time needing to contain as much information as possible. Although many economists have tried, since the 1950s, to find consistency by comparing people's economic behaviour at different income levels, their results are of limited value due to their lack of a comprehensive assessment based on an overall evaluation of economic developmental structural changes and staged characteristics. In his book *Patterns of Development*, *1950–1970*, Chenery chose 27 variables and 101 countries from the World Bank's socio-economic database, and then systematically analyzed and compared the three most fundamental processes, including different income levels and their corresponding wealth accumulation processes (investment, government revenue and education), resource allocation processes (the structure of domestic demand, production and trade) and social wealth allocation processes among the population (the distribution of labour and its income, urbanization and demographic transition) (Chenery *et al*., 1975). Furthermore, he analyzed more elaborately the industrial structure transformation of different GNI per capita groups in his other book *Industrialization*

and Growth: A Comparative Study, encompassing primary production (agriculture and mining), manufacturing industry (machinery, produce, consumption goods and food), non-trading industry (service and social infrastructure) and so on. He also discovered the stage differences of dissimilar economic variables at varying income levels (Chenery *et al*., 1986), and solved the problem of the stability and temporal trend of national development patterns at different income levels, revealing the rich implication of per capita GDP and its significance in dividing economic development stages. From then on, per capita GDP became the most general index in assessing economic development stages, and it has been widely used by international and regional organizations like the World Bank.

Certainly, there is no perfect research method; every method has its own pros and cons. Nevertheless, there is no denying that per capita GDP provides an optimal approach for researchers to get to know and grasp the general state of economic development. It largely reflects a country or region's overall wealth level and measures the corresponding capital accumulation boundary, basically covering the purchasing power and demand structure of an economy. Therefore, the rich implication of per capita GDP has justified its own significance in effectively and accurately manifesting the prime features of different economic development stages, especially compared with other index systems, in certainty and authority. Chenery provided a concrete definition of the classification criterion in *Industrialization and Growth: A Comparative Study*, which is the most widely used, convenient and authoritative classification criterion in the fields of Regional Economics, Developmental Research, Urban Planning and so on. However, relevant domestic research tends to temporarily misrepresent this classification criterion in two ways, by either underestimating or overestimating the economic development level, due to the misuse of unverified exchange rates. Therefore, this paper tries to re-assess the classification with reference to Chenery's criterion, which means extrapolating the 1970s classification to 1971–2010, employing the purchasing power of the US dollar in 1970 as the fair price conversion factor[1], and taking the US dollar to RMB exchange rates from 1971 to 2010 to convert it into RMB. Table 1 shows the comparison of specific classification criteria based on US dollars in various years, while Figure 2 is the classification results using RMB as the classification criterion.

Table 1 Classification criterion of economic development stages by Chenery (US$)

Stage	Stage name	1970	1990	1995	2000	2005	2010
1st stage	Primary product stage I	100–140	340–470	393–550	440–620	500–710	560–790
	Primary product stage II	140–280	470–940	550–1100	620–1240	710–1410	790–1570
2nd stage	Primary industrialized stage	280–560	940–1890	1100–2200	1240–2490	1410–2820	1570–3150
	Middle industrialized stage	560–1120	1890–3770	2200–4400	2490–4970	2820–5640	3150–6300
	Late industrialized stage	1120–2100	3770–7070	4400–8250	4970–9320	5640–10570	6300–11,810
3rd stage	Primary developed stage	2100–3360	7070–11,310	8250–13,200	9320–14,910	10,570–16,920	11,810–18,900
	Developed stage	3360–5040	11,310–16,970	13,200–19,800	14,910–22,380	16,920–25,380	18,900–28,350

Note: The degree of precision is 10, which is in accordance with that of World Bank's data.

[1] Chenery stressed that the deflator of US dollar was non-negligible and indispensable in building the critical standard value of per capita GDP and formulating the classification criterion for economic development stages in *Industrialization and Growth: A Comparative Study*.

2.3 Identifying the evolution of spatial patterns

In order to evaluate the spatial effect of economic development and uncover its evolution rule, we analyzed the spatial dependence and heterogeneity of city development stages with spatial correlation analysis techniques by identifying the hot spot or concentrating regions of spatial correlation. More specifically, we chose the Global Moran I and the Getis–Ord Gi* to analyze the study area on the global and regional scales, respectively.

$$GMI = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}(X_i - \overline{X})(X_j - \overline{X})}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}} \qquad G^*_i(d)^2 = \sum_{j=1}^{n} W_{ij}(d)X_j \Big/ \sum_{j=1}^{n} X_j$$

where

$S^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2$, $\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$, $Z(G^*_i)^2 = G^*_i - E(G^*_i)\Big/\sqrt{Var(G^*_i)}$, n is the number of prefectures, X_i and X_j are the values of X in the units of i and j, respectively, and W_{ij} is the spatial weight matrix built on the utilization of adjacency standard, while GMI represents the judgment of the accumulation and diffusion states of the observations at the given significance level, and the significance level of Z(G*i) is used to identify the spatial distribution of different hot-spot and cold-spot regions.

2.4 Data sources

According to the official book *The Administrative Districts of PRC*, China had 333 prefectural administrative districts and 343 statistical units for the sake of spatial consistency and coverage at the national level in 2010, excluding Hong Kong, Macao and Taiwan. Given the availability and integrity of the relevant data, we chose more than 6800 groups of data between 1990 and 2010 for our analysis, and picked 1990, 1995, 2000, 2005 and 2010 as five time periods to carry out analysis of the regional economic development stage and its spatial evolution. For administrative districts where the historical data was not directly comparable with that of 2010, we tried our best to simulate and monitor the historical economic development levels by adjusting the administrative systems in various years and making them consistent over the study period.

Data for this research are collected mainly from *The China Statistical Yearbook for Regional Economy 2000–2011*, *The China Statistical Yearbook 1991–2011* and T*he China City Statistical Yearbook 1949–1999*. Most of the missing data are gathered from other sources, such as provincial yearbooks. The rest are calculated by interpolation based on the average growth rate over many years.

In this paper, Eastern, Central and Western China refer to the terrestrial division of the Seventh Five-Year Plan passed by the National People's Congress in 1986. In 1997, Chongqing became a municipality of China and fell into the category of the West, and Inner Mongolia and Guangxi also became parts of the West, owing to the state policy of the *Great Development of Western China* in 2000. For that reason, Eastern China consists of Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan, Central China is made up of Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan,

Hubei and Hunan, and Western China is composed of 12 provincial administrative districts including Sichuan, Chongqing, Guizhou, Yunnan, Xizang, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Guangxi and Inner Mongolia.

3 Assessing the overall developmental stage and pattern of the Chinese economy at the prefectural level

At the national level, per capita GDP was RMB29,992 yuan in 2010, obviously in the Middle Industrialized Stage. From a historical perspective (Figure 1), however, we have to admit that although China had primarily established a quite complete industrial system, the economy before 1978 was still underdeveloped overall. China's per capita GDP was only 381 yuan (US$242) in 1978. The country was still at the Primary Product Producing Stage until the year of 2003, when the preparation for industrialization was generally completed. Afterwards, the Chinese economy rapidly developed, and has been in the Middle Industrialized Stage since 2008. It is valid to say some research overestimated the industrialization process in China according to this international standard.

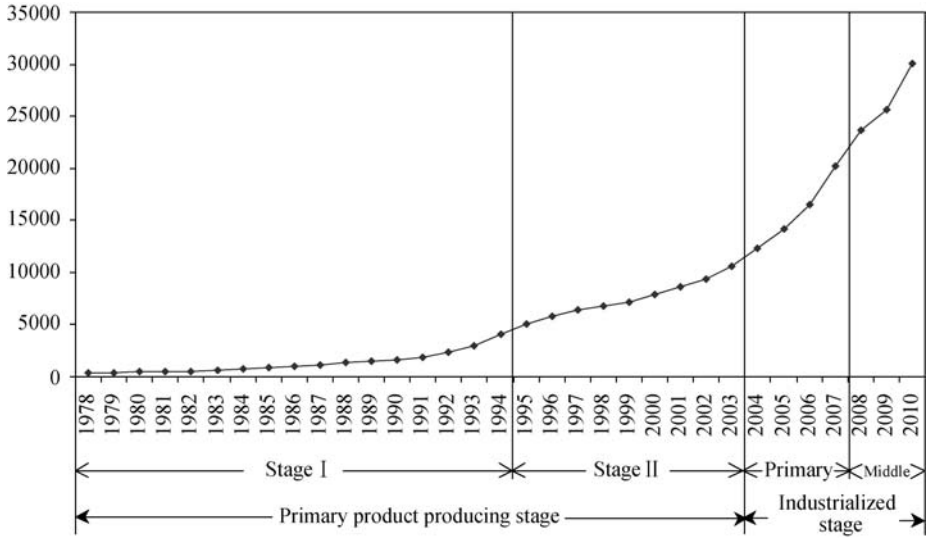

Figure 1 Stages of China's economic development by Chenery (yuan)

According to the results shown in Table 2, the Chinese economy has always been in the relatively concentrated development stage, as all the Moran I values were above zero and all prefectural per capita GDP, from 1990 to 2010, could pass the test within the 99% confidence level. More specifically, Moran's I value was only 0.07 in 1990, compared to 0.27 in 2004, indicating that the Chinese economy was gaining momentum in clustering and agglomerating during this period. Thereafter, Moran's I's growth rate, although still quite remarkable, gradually slowed down, with each year's value decreasing since 2005, which meant that the development pattern of the Chinese economy was largely unbalanced, although the imbalance was decreasing over time.

In Figure 2, it can be seen that China's economic development showed a 'balanced–unbalanced–gradually rebalanced' trajectory. To be more specific, it shifted from the balanced

Table 2 Global Moran's I of per capita GDP in Chinese preferences

Year	Moran'I	z Score	Year	Moran'I	z Score
1990	0.07	5.5	2001	0.23	17.37
1991	0.07	5.43	2002	0.19	14.07
1992	0.09	7.6	2003	0.26	19.69
1993	0.11	9.01	2004	0.27	19.95
1994	0.11	8.79	2005	0.23	16.92
1995	0.11	9.43	2006	0.22	16.56
1996	0.11	9.04	2007	0.22	16.55
1997	0.14	12.06	2008	0.2	15.13
1998	0.16	14.23	2009	0.19	14.3
1999	0.24	17.62	2010	0.19	14.29
2000	0.22	16.63			

Note: All the types can be divided into 3 groups, that is, 'Clustered', 'Dispersed', and 'Random'. And all the data from 1990 to 2000 can pass the significance test of 1% confidence interval, indicating that all the corresponding types are 'Clustered'.

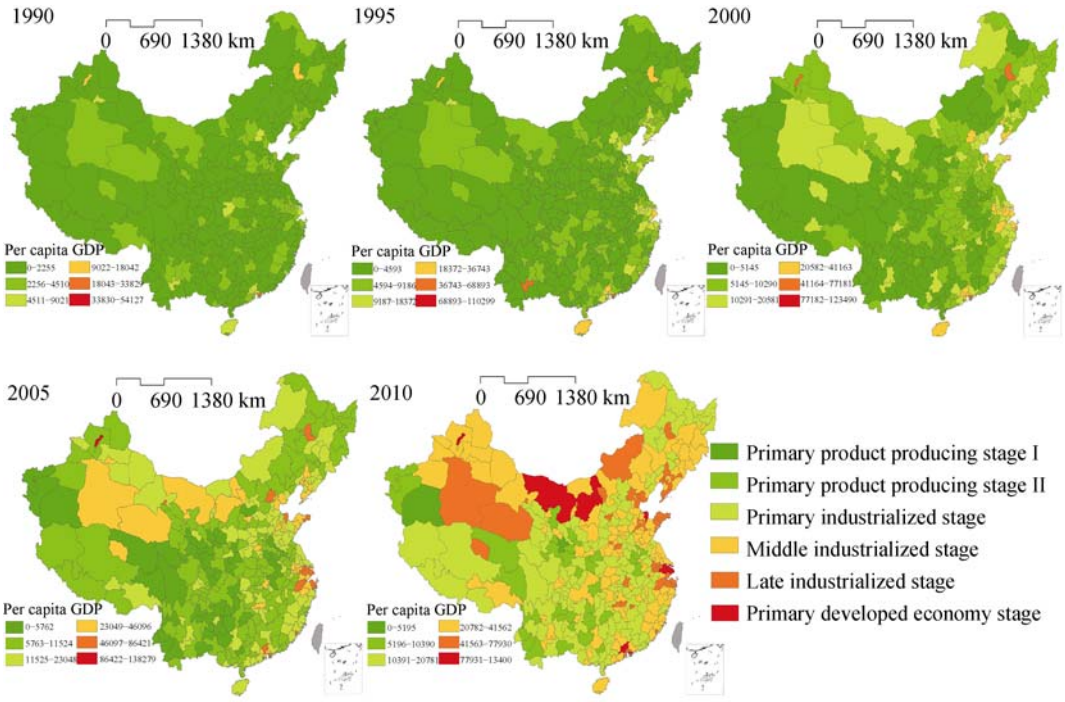

Figure 2 The externalized analysis of Chinese economic development stages based on the exclusive index of Per Capita GDP between 1990 and 2010

state at a lower level in 1990, to an unbalanced state in 2000, then to a relatively balanced state at a higher level in 2010. The current relatively balanced state is the result of the competition between east coastal areas, resource-rich provinces, such as Inner Mongolia and Xinjiang, and the inland areas.

At the prefectural level, it seems that, in 1990, most of the administrative districts (95.29%) were in the Primary Product Producing Stage, with 74.64% in phase I, except for

cities such as Beijing, Shanghai and Shenzhen, and resource-rich regions like Daqing, Karamay and Urumqi, all of which had entered the Industrialized Stage. In 2000, 77.55% of all the administrative districts were still in the Primary Product Producing Stage, but the proportion of prefectures in phase II had climbed remarkably, to 41.2%, and 21.58% of the prefectures moved into the Industrialized Stage. By 2010, 86.59% of the administrative districts were in the Industrialized Stage, and 3.21% managed to make their way to the Primary Developed Economy Stage, while the rest, 10.20%, were left behind and still struggled in the Primary Product Producing Stage. From the perspective of spatial distribution, all the administrative districts entering the Industrialized Stage fell into three types, namely the east coastal urban agglomeration, the resource-rich regions, and the regional central cities in the centre and west. In Table 3, we can see that development stages at the prefectural level were clearly shaped like a pyramid in 1990, which was evidently weakened in 2000, with the increase in the number of prefectures in the Primary and Middle Industrialized Stages leading to a swelling in the middle of the pyramid. Nevertheless, it was not until 2010 that this pyramid of distinct polarization turned into the relatively reasonable shape of spindle apparatus.

Table 3 Classification of economic development stages based on the exclusive index of per capita GDP in 1990, 2000 and 2010

	Development stage	1990		2000		2010	
		Number	%	Number	%	Number	%
1st stage	Primary product producing stage I	256	74.64	124	36.15	2	0.58
	Primary product producing stage II	73	21.28	142	41.40	33	9.62
2nd stage	Primary industrialized stage	11	3.21	56	16.33	134	39.07
	Middle industrialized stage	2	0.58	18	5.25	123	35.86
	Late industrialized stage	1	0.29	3	0.87	40	11.66
3rd stage	Primary developed economy stage	0	–	0	–	11	3.21

4 The changing spatial patterns of Chinese economy at the prefectural level

4.1 The overall spatial evolution of China's economic development: from the coastal areas moving to inland

With prefectures in various development stages, Chinese economic spatial development between 1990 and 2010 has been significantly characterized by its apparent spread from the coastal areas towards the inland areas (Table 4). In 1990, 14 administrative districts entered the Industrialized Stage, with nine of them located in Eastern China, accounting for 64.28% of the total. It was quite easy to spot this coastal concentration, as only Karamay, Urumqi and other specialized cities from Central and Western China, for which petrochemicals were their leading industry, were in the Primary Industrialized Stage. In 2000, 77 administrative districts moved into the Industrialized Stage, 64.93% of which (50) were in Eastern China, while Western (18) and Central (9) China only accounted for 23.38% and 11.69%, respectively. Therefore, it is well grounded to say Eastern China took the lead in shaping China's industrialization and its overall economic development, as 20 cities of the Middle and Late

Industrialized Stages were from Eastern China, along with Karamay and Daqing.

In 2010, Central and Western China showed a remarkable increase in the number of cities in the Industrialized Stage, leading to a higher level of spatial equality in terms of the number of prefectures entering the Industrialized Stage. China's economic centre of gravity was gradually shifting from the east coastal area to Central and Western China, which dramatically altered the regional development pattern. For instance, 308 prefectural administrative districts entered the Industrialized Stage, which were evenly distributed in Eastern, Central and Western China. More specifically, 123 regions went into the Middle Industrialized Stage with Eastern, Central and Western China accounting, respectively, for 38.21%, 31.71% and 30.08% of the total. What is more, 40 regions were in the Late Industrialized Stage, with 65%, 20% and 15% from Eastern, Central and Western China, respectively, while 11 regions were in the Primary Developed Economy Stage, with Eastern and Western China accounting for 63.64% and 36.36% of the total, respectively. Therefore, we can conclude that the Chinese economy has faced a great shift from 'unbalanced development' to 'balanced development'.

Table 4 The prefecture number and its proportion of different economic development stages based on the exclusive index of per capita GDP

	1990						2000						2010					
	Eastern		Central		Western		Eastern		Central		Western		Eastern		Central		Western	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Primary product producing stage I	59	22.78	91	35.14	109	42.08	10	8.06	34	27.42	80	64.52	0	–	0	–	2	100.0
Primary product producing stage II	34	48.57	16	22.86	20	28.57	42	29.58	66	46.48	34	23.94	0	–	6	18.18	27	81.82
Primary industrialized stage	8	72.73	1	9.09	2	18.18	31	55.36	8	14.29	17	30.36	22	16.42	56	41.79	56	41.79
Middle industrialized stage	0	–	1	0.50	1	50.00	18	100.0	0	–	0	–	47	38.21	39	31.71	37	30.08
Late industrialized stage	1	100	0	–	0	–	1	33.33	1	33.33	1	33.33	26	65.00	8	20.00	6	15.00
Primary developed economy stage	0	–	0	–	0	–	0	–	0	–	0	–	7	63.64	0	–	4	36.36

4.2 A historical evaluation of the spatial interaction: hot-spots moving towards the North and the West

As shown in Figure 3, hot-spot regions were concentrated in the Pearl River Delta region, Xinjiang and Northeast China in 1990. Beginning with the Reform and Opening-up Policy, the Pearl River Delta region has been presented as an example of a good interactive development trend in support of national policies. Because of the Dominant Resource Transformation Strategy and industry-led development strength, the northern slopes of the Tianshan Mountains and Northeast China have been hot-spot regions. Sub-hot-spot regions were agglomerated in the Pan-Pearl River Delta region, the Yangtze River Delta region, the Bohai Rim, and the border region of Xinjiang, Gansu and Inner Mongolia, which faithfully reflected the regional development pattern shaped by state economic development strategies before the 1990s.

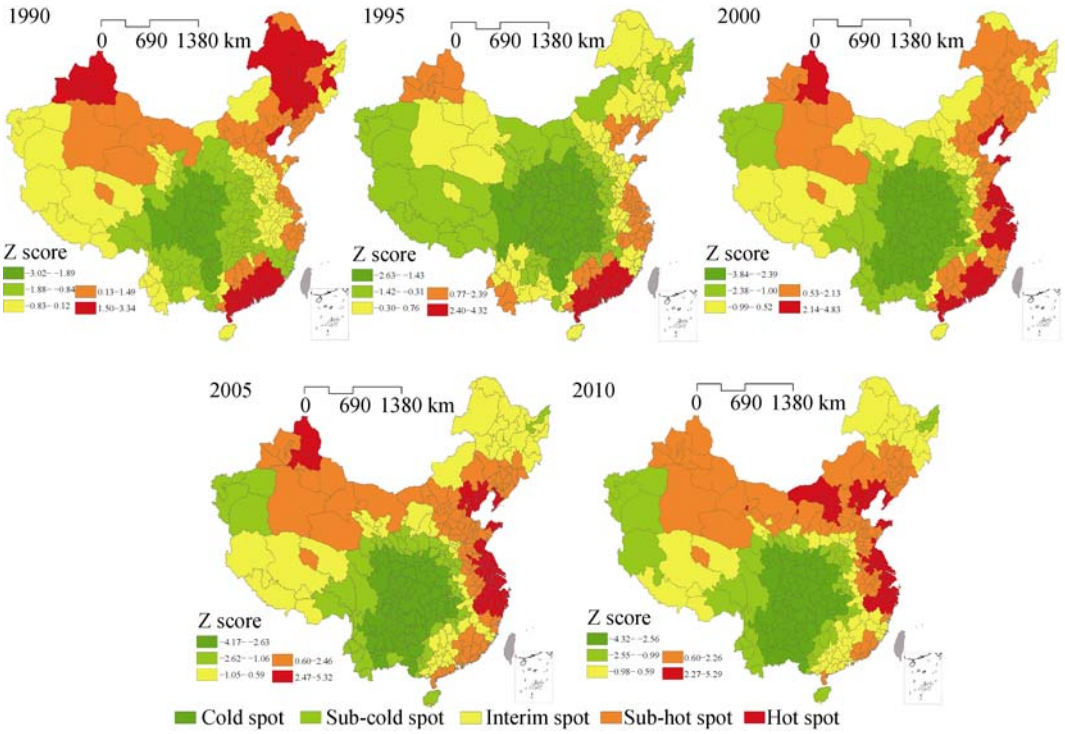

Figure 3 Evolution of China's economic spatio-temporal pattern based on prefecture

By 1995, however, the lasting effect of the development advantage had faded. Northeast China was stuck in some sort of development jam and was faced with many pressures. In the meantime, Inner Mongolia declined from sub-hot-spot level to sub-cold-spot level, due to the declining effect of resource exploitation on regional development, while the surrounding areas of Kunming, in Yunnan province, were upgraded to sub-hot-spot level. By contrast, the Pearl River Delta region developed into the most prominent hot-spot region, with the fastest growth rate, as the Yangtze River Delta region gained momentum in leading and driving the development of the surrounding regions. China's economic centre of gravity began to shift towards the south.

Tremendous changes took place in terms of the distribution of hot-spot regions in 2000 (Figure 3), which were densely located in the Pearl River Delta region, the Yangtze River Delta region, the Bohai Rim and Urumqi metropolitan area and Altay in Xinjiang, indicating an evident 'up-to-the-north and down-to-the-south' trend. Compared with that of 1990, the range of hot-spot and sub-hot-spot regions underwent quite a recognizable adjustment in 2000. For instance, the spatial scope of the hot-spot region surrounding the Pearl River Delta shrank a little, while that centred on the Yangtze River Delta enlarged a little to incorporate the surrounding prefectures, exhibiting a distinct interactive development trajectory. Despite the lack of a typical agglomerated hot-spot region in the Bohai Rim, there was no denying that the urban hot-spot agglomeration regions of Shandong Peninsula and middle and southern Liaoning were quite outstanding in all aspects. In comparison with 1990, the hot-spot and the sub-hot-spot regions showed some sort of interactive development trend in Eastern China in 2000, as those regions were mostly clustered in the east coastal area, Northeast

China and Western China, which meant that not only did Eastern China gain its own development goal, but also it effectively facilitated the development of peripheral regions, and this East-oriented pattern clearly led to the quite distinct gradient structure of China's economic development.

In 2005 and 2010, the extent of the hot-spot regions contracted again, mainly covering the Yangtze River Delta region, the Bohai Rim and the middle and west of Inner Mongolia, with the Bohai Rim and its hinterland becoming a brand-new member of this dynamic hot-spot club. However, the sub-hot-spot regions stretched from the hinterland of the Yangtze River Delta region, the Bohai Rim and its hinterland, Inner Mongolia, to Xinjiang. The hot-spot and sub-hot-spot regions formed a 'T-shaped' spatial pattern, that is, the Bohai Rim–Inner Mongolia–Xinjiang formed the cross-bar and the Bohai Rim–Yangtze River Delta region was the upright. In short, given the existing spatial pattern of China's economic hot-spot regions, the economic centre of gravity moved towards the north and west. The underlying reason for the movement of China's economic centre of gravity towards the north was that the Pearl River Delta region and the Yangtze River Delta region gradually stepped into the industrial connotative development phase and the Bohai Rim made good use of the advantage bestowed by its relative backwardness, which was especially true with the three urban agglomerations of Beijing–Tianjin–Hebei, the Shandong Peninsula and middle and southern Liaoning. In the meantime, resource-rich regions like Inner Mongolia and Xinjiang owed much of their economic development, to some extent, to a new round of large-scale resource exploitation, which propelled the primarily westward shift of China's economic centre of gravity.

4.3 A historical evaluation of the spatial interaction: isolated development of large cities in inland China

Figure 3 shows a regional development gradient trend dividing the whole country into hot-spot, sub-hot-spot, interim spot, sub-cold-spot and cold-spot regions, ranging from the east coastal area to the interior. Some regions in Central and Western China, such as Sichuan, Chongqing, Guizhou, Hunan, Hubei, Shanxi, Gansu and Ningxia showed great resistance to changing their position as cold-spot-regions or agglomerations. The aggregate percentages of these regions to the total number of sub-cold-spots fluctuated from 92.13% in 1990 to 98.27% in 2000 to 96.67% in 2010 (Table 5). On the whole, the agglomeration of cold-spot or sub-cold-spot regions in Central and Western China was showing less propensity to change and becoming more rooted, year on year, despite the widespread changes over the two decades from 1990 to 2010; together with Eastern China this certainly contributed quite a lot to the formation of the spatial patterns of regional development on the national scale. Meanwhile, it was notable that those hot-spot, sub-hot-spot, interim, sub-cold-spot, and cold spot regions exhibited a kind of concentric zone structure.

As analyzed above, although all of those regional central cities in Central and Westernb regions, such as Chongqing, Wuhan, Chengdu, Xi'an and some other resource-rich industrialized cities entered the Middle Industrialized Stage, they remained in the individual unit phrase of urban development, with limited interactive effect and influence on their peripheries, as almost all of those cities were situated in the agglomeration of cold-spot and sub-cold-spot regions, according to the results of the spatial correlation analysis, which per-

fectly coincided with a recent research finding (Liu *et al*., 2012). Clearly, the polarization effect beat the trickle-down effect in this particular area during the period studied, and three reasons accounted for this phenomenon, as follows. First, some cities were still in the phase of attracting concentrating industries transferring from Eastern China, so it was beyond their power to facilitate either the development of the peripheral regions or the formation of a regional interactive development pattern. Second, those resource-rich cities were not sufficiently large or well endowed with resources, which placed restraints on their development and their regional links with other economic centres. Third, those administrative districts tended to build their economy in a rather shaky and backward manner, so it is not surprising that they were in a rather poor position in terms of both economic development and industrial level. A telling factor for this is that all the 35 administrative districts that were left behind and could not make their way to the industrialized stage were located in Central and Western China.

Table 5 The number and proportion of different areas of hot- and cold-spots

	1990						2000						2010					
	Eastern		Central		Western		Eastern		Central		Western		Eastern		Central		Western	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Hot-spot region	28	49.12	15	26.32	14	24.56	52	83.87	6	9.68	4	6.45	36	70.59	6	11.76	9	17.65
Sub-hot-spot region	44	63.77	10	14.49	15	21.74	39	42.39	34	36.96	19	20.65	41	46.07	25	28.09	23	25.84
Interim spot region	23	26.74	35	40.70	28	32.56	10	21.28	18	38.30	19	40.43	23	32.86	19	27.14	28	40.00
Sub-cold-spot region	7	7.87	49	55.06	33	37.08	1	1.72	31	53.45	26	44.83	2	3.33	30	50.00	28	46.67
Cold-spot region	0	–	0	–	42	100.0	0	–	24	28.57	60	71.43	0	–	19	26.03	54	73.97

4.4 A spatial analysis of the declining growth rate: the rise of inland China

The average national growth rate between 1990 and 2000 was 17%, and that from 2000 to 2010 was 14%, indicating a decrease in the overall growth rate. More specifically, the number of administrative districts with the highest growth rates fell from 46 to 7, and that of prefectures with higher growth rates dropped from 128 to 49. Furthermore, administrative districts with the highest growth rates agglomerated in the east coastal area between 1990 and 2000, with Central and Western China together accounting for only 28.26%. All the administrative districts with the highest growth rates were located in Central and Eastern China from 2000 to 2010. 24.48%, 20.41% and 55.10% of the administrative districts with higher growth rates were in Eastern, Central and Western China, respectively, between 2000 and 2010, while comparable shares during the period between 1990 and 2000 were 32.03%, 33.59% and 34.38%, respectively. While the average growth rates of many prefectures were higher than 15%, those of prefectures located in coastal areas varied between 10% and 15% from 2000 to 2010 as they entered the structural adjustment phrase, and the Pearl River Delta region was confronted with low growth rates. China's economic growth centre apparently drifted westward from 1990 to 2010.

As is shown in Figure 4, 84 hot-spot and sub-hot-spot regions with higher growth rates mainly concentrated in the east coastal area, and Eastern and Central China accounted for

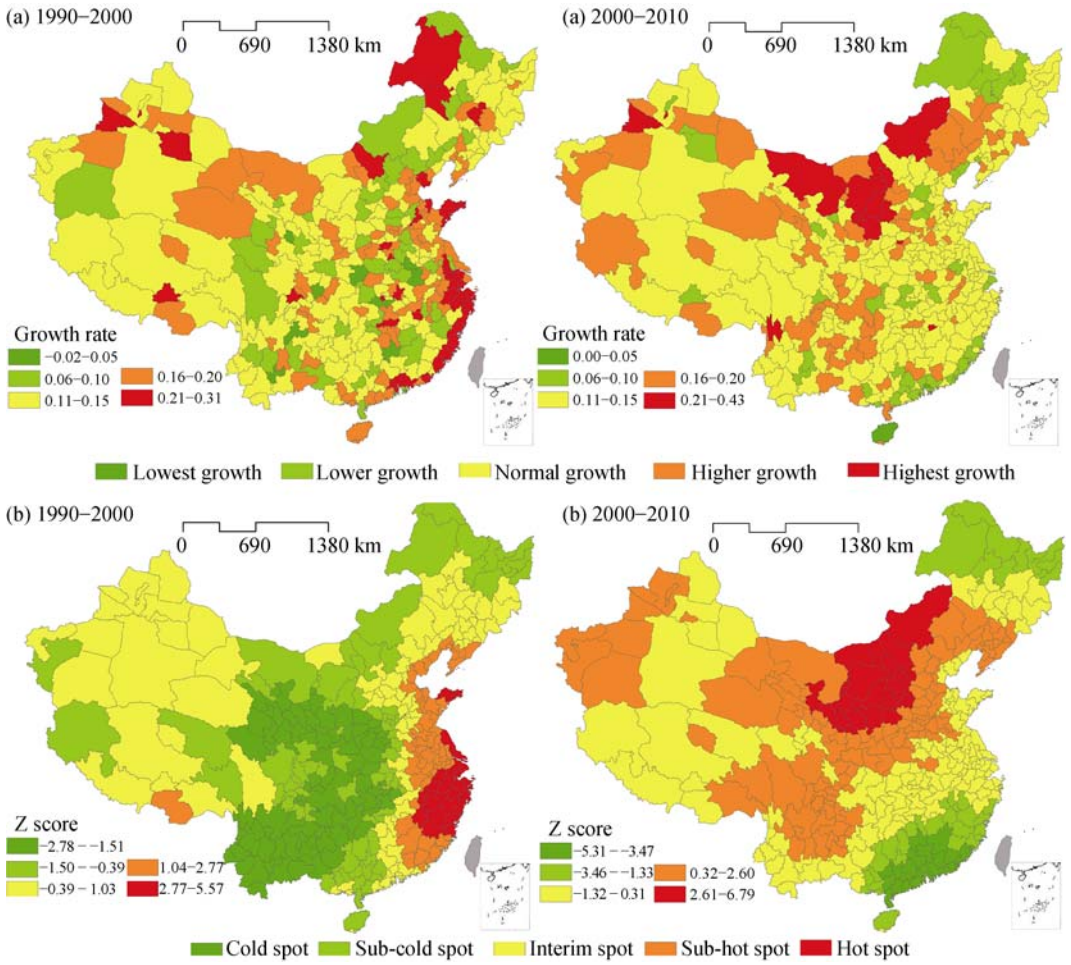

Figure 4 Classification of speed level of economic growth (a) and evolution of its spatio-temporal pattern (b)

71.43% and 28.57% (60 and 23), respectively, located mainly in Shandong, Liaoning, Jiangsu, Zhejiang, Fujian and Guangdong in the east coastal area, and Jiangxi and Anhui in Central China. Between 2000 and 2010, however, 143 hot-spot and sub-hot-spot regions, with the highest and higher growth rates, primarily agglomerated in Central and Western China, among which 27 were the hot-spot regions of Inner Mongolia, Ningxia and Shanxi and 116 were sub-hot-spot regions, with Eastern, Central and Western China accounting for 26.72%, 56.90% and 16.38%, respectively. Contiguous agglomerations of hot-spot regions started to pop-up in Central and Western China, while the Pan-Pearl River Delta region was gradually showing a greater propensity for cold-spot and sub-cold-spot agglomerations to emerge, which reinforced the conclusion that growth in the Pearl River Delta region was declining and its regional economic linkages were weakening at the same time.

4.5 Concentrating on resource-based cities: charming growth curve with uncertainties

Most cities entering the Industrialized Stage in Central and Western China were resource-based and could be divided into two groups: resource-based cities widely distributed in the vast hinterland, and resource-rich regions with more regional interaction with the pe-

ripheries. The former, dominated by the energy and raw material industries, were located mainly in Sichuan, Guizhou, Yunnan and Gansu, while the latter could be found mainly in Xinjiang and Inner Mongolia. From Figure 5, it can be seen that 91.67% and 80%, respectively, of the prefectures in Xinjiang and Inner Mongolia were in the Industrialized Stage, far more than other provinces in Central and Western China. Furthermore, in 1990 Xinjiang and Inner Mongolia together accounted, respectively, for 11 and 8 out of 14 hot-spot and 15 sub-hot-spot regions, which meant 78.57% and 53.33%, respectively, of the total. In 2000, Xinjiang and Inner Mongolia, respectively, accounted for 2 and 13 out of 10 hot-spot and 19 sub-hot-spot regions, which represented 20% and 68.42% of the total, respectively. However, in 2010, Xinjiang and Inner Mongolia, respectively, accounted for 5 and 16 out of 6 hot-spot and 23 sub-hot-spot regions, representing, respectively, 83.33% and 69.57% of the total.

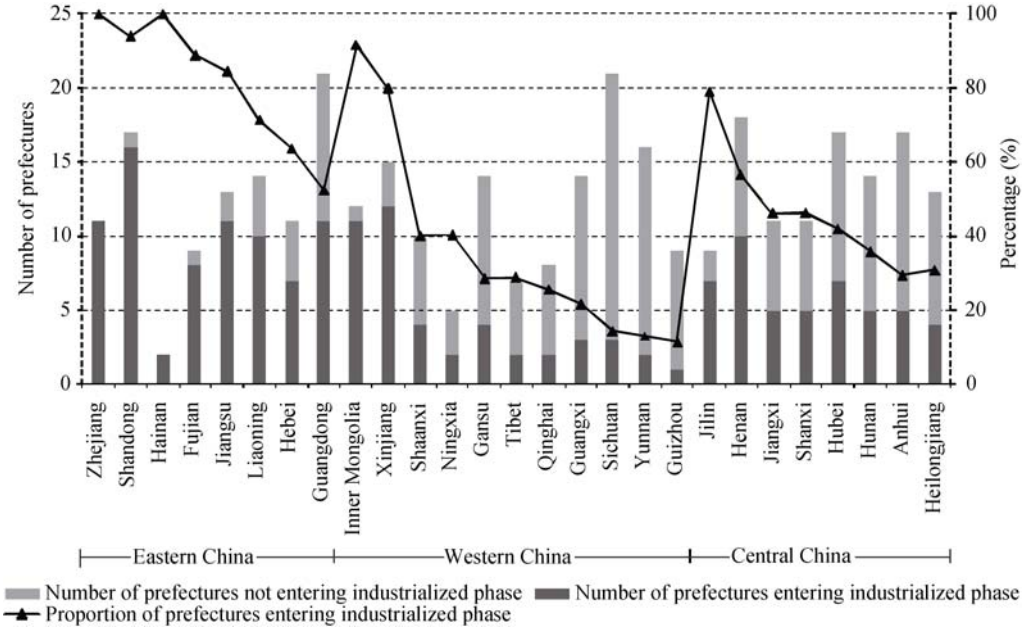

Figure 5 Number of prefectures in the industrialized phase, and the proportion in each province

In terms of per capita GDP, Urumqi and Karamay in Xinjiang and Daqing in Heilongjiang were at the same level as Shenzhen, Guangdong and Shanghai as they were all at the Industrialized Stage. In 2000, Wuhai, Baotou, Alashan and Hulun Buir in Inner Mongolia and Turpan and Bayingolin in Xinjiang were up to the standard of the Industrialized Stage, as the coal mining, petroleum refining and ferrous metallurgy industries in these regions were well-developed, and this was especially true of Karamay. In 2010, Chifeng, Ulan Qab, Tongliao and Bayannur in Inner Mongolia and Hami Prefecture, Yili, Changji and Turpan in Xinjiang were in the Middle Industrialized Stage given their per capita GDPs, and Bayingolin in Xinjiang and Hohhot, Wuhai and Xilingol in Inner Mongolia were up to the standard for the Later Industrialized Stage with their per capita GDPs. The per capita GDPs of Alashan and Erdos were even up to the standard of the Primary Developed Economy Stage.

Among those regions, Karamay was superior to Erdos, Wuhai and Alashan as the industries in Karamay were more advanced. However, we should also note that these regions, in

general, were confronted with the negative effects of unbalanced industrial structure resulting from their specific development model, before making an objective evaluation of their development stages. Worse still, the populations in these regions were generally small, so the relatively high per capita GDP did not guarantee sufficient wealth accumulation to facilitate development of the whole region. This is the greatest disadvantage of per capita GDP as the sole indicator for evaluating the development stage, as it may mask regional problems of unbalanced industrial structure and lagging social development. Therefore, we need to be vigilant and sufficiently wise in mapping out regional strategies so as to break the 'resource curse'.

5 Discussion and conclusions

A host of conclusions can be drawn, based on different assessment criteria, but what we really need at present is to evaluate China's economic development stage and its spatio-temporal features at the prefectural level so as to formulate reasonable regional policies to promote further development of the nation. This paper comes up with some useful conclusions through the analysis of China's overall economic development and the spatio-temporal rules of its evolution as follows.

(1) The evaluation results by prefecture showed China's overall economic development entered the Middle Industrialization Stage in 2010 from the Primary Production Stage in 1990, with quite a remarkable spatial discrepancy of regional economic development stages and an evident overall zonal differentiation characteristic. Spatially, the administrative districts entering the Industrialized Stage mainly clustered in the east coastal urban regions, such as the Pearl River Delta region, the Yangtze River Delta region and the Bohai Rim, and in resource-rich regions and the regional central cities in Central and Western China. However, some regions in Central and Western China still have not made their way to the Industrialized Stage.

(2) China's economic development was largely unbalanced, but this pattern has declined over time. It is evident that the Chinese economic development pattern showed a 'balanced–unbalanced–gradually rebalanced' trend. China's economic centre of gravity has gradually shifted inland from the east coastal area. The spatial interactive effect of the east coastal area showed the trend of 'up-to-the-north and down-to-the-west', while China's economic hot-spot regions drifted 'northward and westward'.

(3) China's economy is faced with a decreasing overall growth rate with Central and Western China outperforming the coastal area in this respect. It seems that 2000 was the watershed, after which the economies of Central and Western China started to take-off, and their growth rates began to surpass that of eastern China. At the same time, contiguous agglomerations of hot-spot regions started to pop-up in Central and Western China, while the Pan-Pearl River Delta region was gradually showing greater propensity for cold-spot and sub-cold-spot agglomerations to emerge over time, which further shows that the growth rates of the Pearl River Delta and the Yangtze River Delta regions are on the decline.

(4) Resource-rich regions are in urgent need of special attention from China's economic growth research and strategic decision-making, as these regions are probably shielded from their regional problems of unbalanced industrial structure and lagging social development when their development stages are assessed in per capita GDP terms, despite the fact that

their economic aggregates are swelling quite rapidly.

However, it should be noted that there are no perfect and absolute criteria for the determination of economic development stages, which equally holds true for Chenery's criteria that have been adopted in this paper. For instance, the evaluation results of Alashan, Erdos and Xilingol in Inner Mongolia were not always consistent with the subjective presumptions, so we should be always on the lookout for this sort of hidden pitfall – that the unbalanced industrial structure and lagging social development in these regions were masked by their comparatively huge GDP aggregates and relatively small populations – when we try to assess development stages in terms of per capita GDP. Further studies are needed to explore and resolve this issue in the future. Although making per capita GDP the only evaluation criterion may produce some less than robust results, which may even conflict with the truth sometime, there is no denying that per capita GDP provides the most widely used and effective approach for researchers to get to understand the general rule of macroeconomic development of a country or region, and it reflects the local economic development level to quite a significant extent. Certainly, some conclusions, like the overall development trend of a shift inland from the Coastal area, the weakening east coastal interactive development effect and the lack of driving force in the regional cities of Central and Western China, would be more well-grounded if we combined the per capita GDP with regional industrial linkages, regional investment flows and regional labour transfer, which hopefully will be our focus in the future.

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