

THE SPATIAL DIVISION OF INDUSTRIES OF THE PEARL RIVER DELTA IN THE 1990s: CHARACTERISTICS AND TRENDS

XU Yong-jian YAN Xiao-pei XU Xue-qiang

(Center for Urban and Regional Studies, Zhongshan University, Guangzhou 510275, P. R. China)

ABSTRACT: The article analyzed the spatial division of industries of the Pearl River Delta (PRD) in the 1990s, a period that witnessed the deepening of the reform and opening policies and continued rapid development of the region. By adopting the index of specialization, the extent of specialization, its change and its spatial distribution in the region are measured and demonstrated. The research revealed that, despite the trend of more balanced development of the secondary sector between the PRD and the rest of the province, in the PRD, it is the unbalanced development that dominated and the spatial division of the secondary sector has been shaped. The tertiary industry has also been experiencing unbalance development and the spatial division of the tertiary sector has been emerging, its extent of concentration appearing even more evident than that of the secondary sector. The author also discussed the linkage between the spatial division of the two sectors. In the end of the paper, the trends of the spatial division of the industries in the PRD are forecasted.

KEY WORDS: Pearl River Delta; spatial division of industries; characteristics and trends

CLC number: F121.3 Document code: A Article ID: 1002-0063(2001)01-0063-07

The Pearl River Delta (PRD) has been the most dynamic region of China in the 1980s. The gross output value of industry and agriculture, gross output value of industry, total amount of retail sales of consumer goods and government revenue are chosen to examine the economic growth of the PRD. From 1980 to 1991, the above-mentioned four indicators increased at annual average rate of 23.92%, 25.16%, 20.05% and 16.32% respectively, being 7.86, 8.43, 5.63 and 4.77 percent points above that of the country. In the 1990s (till 1998 of which the statistics are available), the PRD has experienced continuing fast growth. From 1991 to 1998, four indicators saw increases at the an-

nual average growth rate of 25.29%, 26.73%, 23.18% and 18.79% respectively, being 3.64, 3.92, 5.66 and 3.33 percent points higher than that of the country.

The export-oriented economy has gathered strength in the PRD in the 1980s, which is reflected in the fact that the amount of foreign capital actually utilized and total amount of exports are the two indicators that have witnessed the most rapid increase of all the economic indicators (LI, 1994). The decade from 1980 to 1990 saw the growth of such two indicators at the annual average rate of 32.64% and 29.29% respectively, being 19.94 and 16.19 points above that of the coun-

Received date: 1999 - 09 - 13

Foundation item: Under the auspices of the National Natural Science Foundation of China (No. 49831030).

Biography: XU Yong-jian (1972 -), female, a native of Changsha City, Ph. D. Her research interest includes urban geography.

try. In the 1990s, the corresponding annual growth rates are 27.39% and 29.97% respectively, being 3.11 and 15.44 percent points higher than that of the country. In 1998, 20.17% of the country's foreign capital actually utilized was in the PRD, and 36.07% of the country's total amount of exports was from the PRD as against 16.55% and 13.11% for the PRD in 1990. The PRD still ranks high in the list of the regions that attract foreign investment and earn foreign exchange in China.

This paper attempts to outline the characteristics of the spatial division of industries of the PRD in the 1990s. It is hoped that some trends in the field will be revealed then, which may be of referential value to the regional industrial development policy making. The PRD here refers to the Pearl River Delta Economic Zone. The author may be disapproved since the analysis doesn't go into those spatial units lower than the prefecture-level cities. Yet such treatment is justified by the fact that the prefecture-level city is an independent spatial unit for industrial development, and such a choice makes it more feasible to collect data of industrial development by item/department of more than one year.

The index of specialization (R_q index) is adopted to examine the status of the PRD in the province's spatial division of the secondary sector and the spatial division of both the secondary and the tertiary sector in the PRD (OUYANG, 1996). As to the calculation of the index, we have:

$$R_q = M_i - P_i \cdot k$$

where M_i stands for the ratio of certain city's output of item i in the whole region's gross output from such item, P_i the ratio of certain city's population in the total of the region, and k is the flexible factor.

Value of the factor k is determined according to the ratio between the income and consumption level of the spatial unit examined and that of the whole region where the unit is placed. To be more in detail, when calculating the extent of concentration of certain specialization activity in the PRD, it is believed that the cities in the delta have similar per capita GDP, so the factor k is 1, in value. While calculating the industrial specialization index of the PRD in the context of the

whole province, the value of factor k is 1.54 for 1991 and 2.34 for 1998. That's because the per capita income of the PRD is 1.54 and 2.34 times that of the whole province in 1991 and 1998 respectively.

1 THE ROLE OF THE PRD IN THE PROVINCE'S SPATIAL DIVISION OF SECONDARY SECTOR IN THE 1990s

Before analyzing the characteristics and trends of the spatial division of industries by item/departments, it is of significance to have a brief review on the PRD's structural change among its three sectors. In the PRD as a whole, the ratio of the output of the primary sector to the secondary and to the tertiary changed from 11:50:39 in 1992 to 7:49:44 in 1998, indicating evident decrease of agricultural output, expansion of the tertiary sector and slightly decrease of the output of the secondary sector. Of the nine cities, similar structural ratio change is experienced by the three sectors of Guangzhou, Shenzhen, Zhuhai and Jiangmen, with the figure changing from 7:47:46, 4:50:46, 7:54:39 and 21:50:29 to 5:45:50, 1:50:49, 5:52:43 and 13:49:38 respectively. Foshan merits special attention since its ratio of the secondary sector dropped by 11 points and the tertiary sector rose by 13 points, causing the figure change from 10:64:26 in 1992 to 8:53:39 in 1998. Yet it is noticeable that Huizhou's structural change of three sectors is at variance with that of the PRD as a whole, since its ratio of the secondary sector rose by as much as 19 points, and the tertiary sector weakened, making the figure change from 27:38:35 to 16:57:27. Similarly, Dongguan, Zhongshan and Zhaoqing raised instead of lowered the share of the secondary sector's output in GDP (from 19:51:30, 23:46:31, 40:36:24 to 9:54:37, 10:52:38, 27:43:30).

Seeing that the secondary sector and the tertiary sector are the foci of dynamism and the backbone to modern economic growth, their characteristics of spatial division other than that of the primary sector are to be examined by our research.

Now analyze the role of the PRD in Guangdong Province's spatial division of the secondary sector (XU, 1999). In the 1990s, the favorably developed

items include electronic and telecommunication equipment, electric equipment and machinery, transport equipment manufacturing, ordinary machinery manufacturing, metal products, raw chemical materials and chemical products, plastic products, food manufacturing, textile and garments. And the role of the PRD in the spatial division of the secondary sector is determined after analyzing the spatial specialization of the above-mentioned 10 items. As shown by Table 1, the concentration level of the 10 items in the PRD has dropped by the end of the 1990s since most of the index of 1998 is only 1/3 to 1/2 that of 1991. Two items, i. e. the transport equipment manufacturing and ordinary machinery manufacturing stood out here, their ratio of the index of 1998 to that of 1991 being 1/5 and 1/13 respectively.

Table 1 Changing role of Pearl River Delta's industry in Guangdong Province (1991 - 1998)

Item	R_i of 1991	R_i of 1998
Electronic and telecommunication equipment	45.47	22.01
Electric equipment and machinery	41.47	21.41
Transport equipment manufacturing	36.07	7.11
Ordinary machinery manufacturing	27.27	2.11
Metal products	36.07	13.61
Raw chemical materials and chemical products	30.97	12.11
Plastic products	33.17	19.41
Food manufacturing	25.97	11.61
Textile	35.37	15.31
Garments	19.47	10.01

Source: Calculated based on the Yearbook of Guangdong of various years.

2 CHARACTERISTICS ANALYSIS ON THE SPATIAL DIVISION OF THE SECONDARY SECTOR OF THE PRD

Fig. 1 to Fig. 10 show the status of spatial concentration of the major items in the secondary sector. Those items with R_i above 0.11 in value are defined as the superiority item in the context of spatial division. It is found that Guangzhou, Foshan and Jiangmen boast several superiority items (being 9, 7 and 6 respectively). Shenzhen has 3 items that have advantage in the spatial division, with the electronic and telecommunication equipment manufacturing being the most outstanding one. As to the rest, Zhuhai and Huizhou each have 1 superiority item while Dongguan, Zhongshan

and Zhaoqing has none.

Table 2 shows the change of the concentration level of above-mentioned items in the PRD from 1991 to 1998. Those items with the extent of increase no less than 0.06 are defined as the intensely concentrating ones, and those items with growth above zero and less than 0.06 as slightly concentrating ones. Those items with zero growth have maintained their extent of specialization in the spatial division. Nine cities fall into three categories. The first is those with one to two intensely concentrating items to dominate over other items that have hardly experienced any concentration process. Such cities can be labeled as "mono-polar" or "bi-polar" cities. "Mono-polar" cities include Shenzhen, Foshan and Zhuhai, and the intensely concentrating items for them are electronic and telecommunication equipment (continuously concentrated in Shenzhen), transport equipment manufacturing and electric equipment and machinery respectively. The "bi-polar" city refers to Guangzhou, food manufacturing and chemical products being the two items that have witnessed intense concentration in the 1990s. Cities that fall into the second category are Jiangmen and Zhaoqing and (Fig. 1 to Fig. 10). They are characterized by enjoying several intensely concentrating items and several slightly concentrating items simultaneously. The intensely concentrating items of Jiangmen include ordinary machinery manufacturing, metal products, transport equipment manufacturing and textile, and electronic and telecommunication equipment and transport equipment manufacturing are the two items that have experienced intense concentration in Zhaoqing. As to the number of the slightly concentrating items, it is 2 for Jiangmen and 5 for Zhaoqing. The third category is characterized by the domination of slightly concentrating items. Dongguan, Huizhou and Zhongshan fall into this category since Dongguan has 6 slightly concentrating items, Huizhou, 5 and Zhongshan, 4. It merits attention that at least one item of each city has maintained its specialization index. Especially, there hasn't been any change to the concentration level of 6 items for Shenzhen and 4 for Zhongshan through the 6 years, which indicates that the position of the two cities in the industrial spatial division of the delta is comparatively

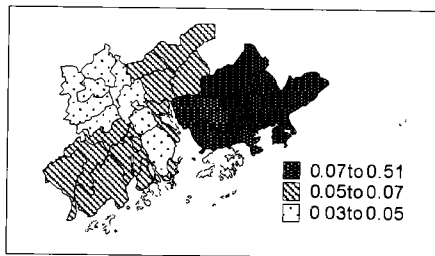


Fig. 1 Extent of specialization of electronic and telecommunication equipment industry of PRD, 1998

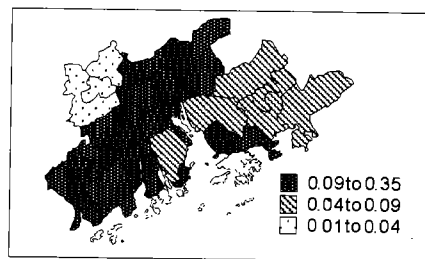


Fig. 2 Extent of specialization of electronic equipment and machinery industry of PRD, 1998

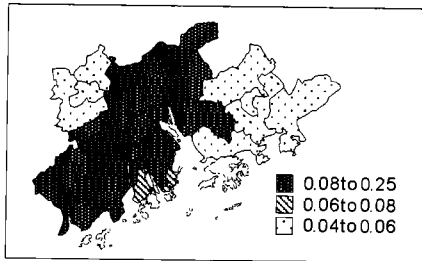


Fig. 3 Extent of specialization of textile industry of PRD, 1998

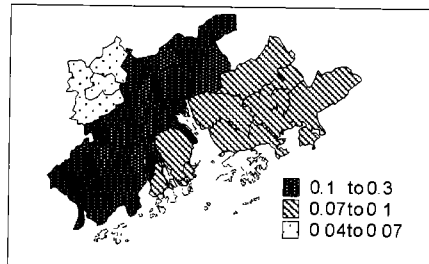


Fig. 4 Extent of specialization of garments industry of PRD, 1998

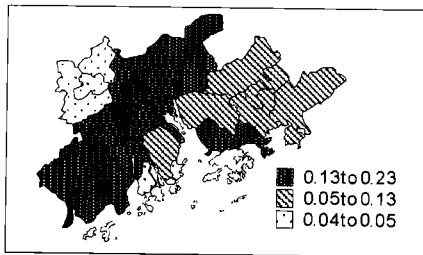


Fig. 5 Extent of specialization of metal products industry of PRD, 1998

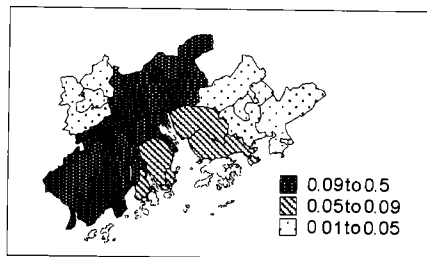


Fig. 6 Extent of specialization of raw chemical materials and chemical products of PRD, 1998

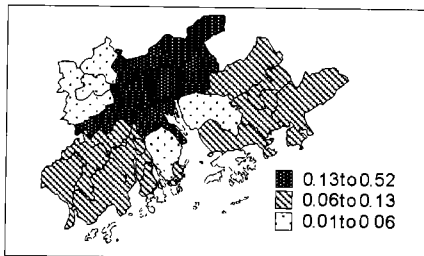


Fig. 7 Extent of specialization of transport equipment manufacturing industry of PRD, 1998

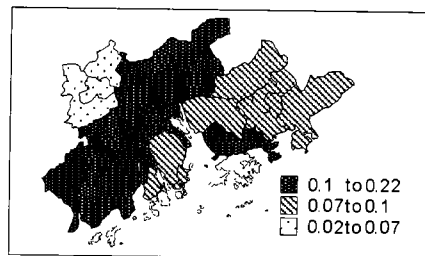


Fig. 8 Extent of specialization of plastic products industry of PRD, 1998

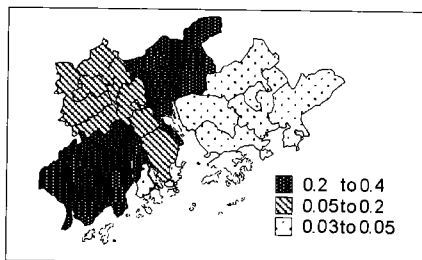


Fig. 9 Extent of specialization of ordinary machinery manufacturing industry of PRD, 1998

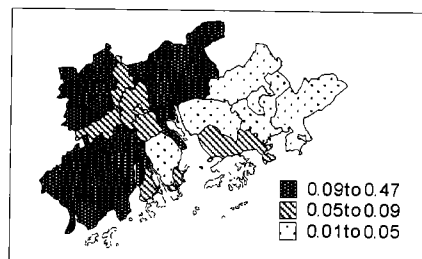


Fig. 10 Extent of specialization of food manufacturing industry of PRD, 1998

Source: Calculated based on the Yearbook of Guangdong of various years.

Table 2 Change of the extent of specialization by major industrial items of Pearl River Delta (1991 - 1998) *

Item	Guangzhou	Shenzhen	Zhuhai	Huizhou	Dongguan	Zhongshan	Jiangmen	Foshan	Zhaoqing
Electronic and telecommunication equipment		* *	-0.03	-0.02	0.03		0.02	-0.07	0.10
Electric equipment and machinery	-0.13		0.09					-0.02	0.04
Textile	-0.03	-0.08			0.05	0.04	0.06	-0.09	0.05
Garments	0.04	-0.13	0.02	0.03	0.05	0.02	-0.02		
Metal products	-0.18		0.02	0.03	0.02		0.12	-0.06	
Raw chemical materials and chemical products	0.10		-0.12	-0.02	0.04			-0.02	0.04
Transport equipment manufacturing	-0.23	0.02		0.03	-0.03	-0.02	0.08	0.07	0.08
Plastic products		-0.18	-0.06	0.03	0.05	0.03	0.04	-0.15	0.05
Ordinary machinery manu				0.03	-0.02	0.02	0.12	-0.03	
Facturingfood manufacturing	0.15		-0.02	-0.02		-0.06	-0.02	-0.06	0.05

* | $R_{i98} - R_{i91}$ | ≤ 0.01 not listed.

** The R_i of Shenzhen in 1991 and 1998 are both 0.51 in value, high above that of other cities.

Source: Calculated based on the Yearbook of Guangdong of various years.

more clearly cut.

To sum up, the pattern of the industrial spatial division of the PRD is well shaped. The cities enjoying the most advantage are Guangzhou, Foshan and Jiangmen, of which at least one item has experienced intensely concentration and several superiority items have taken form by 1998. They are followed by Shenzhen and Zhuhai, who have both spared no efforts in raising the status of one item in the spatial division and making it the superiority one. Zhaoqing can be classified as city on the third rank, since one item (electronic and telecommunication equipment) has raised its spatial

concentration level through the six years despite the fact that it has no superiority item till now. The cities with least advantage are Huizhou, Dongguan and Zhongshan where no significant concentration process has occurred and no superiority items have formed.

3 CHARACTERISTICS ANALYSIS ON THE SPATIAL DIVISION OF THE TERTIARY SECTOR OF THE PRD

From Table 3 we know that there is no sign of evident concentration of the tertiary sector in certain

Table 3 Change of the extent of specialization of the tertiary sector in Pearl River Delta (1992 - 1998)

	Guangzhou	Shenzhen	Zhuhai	Huizhou	Dongguan	Zhongshan	Jiangmen	Foshan	Zhaoqing
1992	0.38	0.21	0.06	0.05	0.04	0.03	0.07	0.10	0.06
1998	0.36	0.24	0.04	0.04	0.05	0.04	0.07	0.12	0.04

Source: Calculated based on the Yearbook of Guangdong of various years.

cities, since the changing range of the value of R_i is no more than 0.03. The spatial difference of the tertiary sector as a whole is not expressive.

Now analyze the spatial division characteristics of the tertiary sector by departments, with the emphasis laid on the circulation department and the producer and social services. It may be added that the former refers to transportation, storage, post and telecommunications, wholesale and retail sale and trades & catering services and the later includes services for agriculture, forestry, animal husbandry and fishery, geological prospecting

and water conservancy, finance and insurance, real estate trade and social services. Table 4 shows the spatial concentration of different departments in the tertiary sector for the nine cities in 1998. It is evident that Guangzhou and Shenzhen have advantage in both departments. The superiority of Guangzhou and Shenzhen is overwhelming over other cities except Foshan and Jiangmen, since they have advantage in the circulation department to some extent.

Table 5 shows the change of the concentration level of the above-mentioned departments of the PRD from

Table 4 Extent of specialization by departments of the tertiary sector in Pearl River Delta in, 1998

	Guangzhou	Shenzhen	Zhuhai	Huizhou	Dongguan	Zhongshan	Jiangmen	Foshan	Zhaoqing
Transportation, sales and trade and catering services	0.34	0.20	0.05	0.05	0.05	0.04	0.09	0.14	0.05
Producer and social services	0.38	0.30	0.04	0.02	0.05	0.03	0.04	0.10	0.03
Education, culture and scientific and technical services	0.36	0.21	0.03	0.05	0.04	0.04	0.10	0.11	0.06
Government agency and social organization	0.30	0.13	0.08	0.06	0.04	0.06	0.11	0.14	0.08

Source: Calculated based on the Yearbook of Guangdong of various years.

Table 5 Change of the extent of specialization by the major departments of the tertiary sector in Pearl River Delta (1992 - 1998) *

	Guangzhou	Shenzhen	Zhuhai	Huizhou	Dongguan	Zhongshan	Jiangmen	Foshan	Zhaoqing
Transportation, sales and trade and catering services	-0.06	0.02	-0.03				0.02	0.05	
Producer and social services	0.03	0.05		-0.03			-0.02		-0.02
Education, culture and scientific and technical services	-0.08	0.08		-0.03			0.03		-0.03
Government agency and social organization	0.02	-0.18	0.04	-0.02	0.02	0.05	0.04	0.06	-0.02

* $|R_{q98} - R_{q91}| \leq 0.01$ not listed.

Source: Calculated based on the Yearbook of Guangdong of various years.

1992 to 1998. Judged by the changing range of R_q index, Dongguan and Zhongshan have maintained their position in the context of spatial division of the two departments. Huizhou and Zhaoqing maintained their position in the circulation department and Zhuhai and Foshan in the producer and social services. It is noticeable that Foshan, Shenzhen and Jiangmen gained advantage in the circulation department and Shenzhen and Guangzhou in the producer and social services. However, the position of both Guangzhou and Zhuhai in the spatial division of the circulation department have weakened and so for the producer and social services of Huizhou, Jiangmen and Zhaoqing.

To sum up, the pattern of the spatial division of the tertiary sector in the PRD can be described as follows. The most striking feature is the overwhelming advantage of Guangzhou and Shenzhen in both circulation department and producer and social services and such advantage are continuously being enhanced (the circulation department of Guangzhou being the only exception). Besides, Foshan and Jiangmen have improved their position in the spatial division of the circulation department and they have gained superiority in this department. On the contrary, the position of the two departments of Zhuhai, Huizhou and Zhaoqing have

weakened in the spatial division and Dongguan and Zhongshan haven't fostered any superiority department.

4 CONCLUDING REMARKS

Firstly, the role of the PRD in the province's industrial spatial division has been weakened to some extent, which reflects the fact that the secondary sector is approaching more balanced development in the whole province. In the PRD, however, it is the unbalanced industrial development that dominates. It is also true that, none of the cities with the ratio of the secondary sector rising has gained superiority in the industrial spatial division. Instead, it is the cities with structurally falling secondary sector and rising tertiary sector that are dominating in the industrial spatial division. Conclusion can be reached that the position of certain region in the industrial spatial division is closely connected with the stage in which it is industrialized. In a broad sense, both the present characteristics and the changing state of the industrial spatial division of the PRD are distinctively featured, leading to the clear-cut hierarchical pattern. Such a pattern is both symbolize and result from the fact that the PRD has entered the medium-term when industrialization is concerned (XU

et al., 1992; 1995).

Secondly, ignoring the subdivision by departments, the spatial difference of the tertiary sector development in the PRD is not so striking. Yet the analysis by department shows that such development is far from balanced. And higher level of spatial concentration is found in this sector other than the secondary sector, since certain cities have almost unsurpassable advantage over others while others hardly improved their situation when certain department in the tertiary sector is concerned.

Thirdly, except for Zhuhai, those cities (Guangzhou, Shenzhen and Foshan) raising their position and therefore gaining superiority in the industrial spatial division did so in the spatial division of the tertiary sector. It is true that the secondary sector is somewhat more complicated, for example, Shenzhen / Foshan, Guangzhou and Jiangmen are different when their changing states of the level of spatial concentration are concerned. Yet it can't be denied that the advantageous regions in the spatial division of the secondary sector coincide with those in the tertiary sector, which reflects the interrelationship between the secondary and the tertiary sectors. It can be inferred that, those factors influencing the tertiary sector's spatial division e. -g. population change and change in the per capita GDP, will probably have impact on the spatial division of the secondary sector. As to the only exception, Zhuhai, analysis shows that it is more advantageous in the spatial division of the secondary sector than in the spatial division of the tertiary sector. Such a conclusion attacks the argument that Zhuhai is able to rely on the tertiary sector for economic prosperity.

As to the trends of the spatial division of industries of the PRD, it is believed that the secondary sector will witness its pattern being deepened with the advance of industrialization, while the tertiary sector may enjoy more flexibility. The developing trends of the circulation department and the producer and social services may influence the trends of their spatial division. Since the development of the circulation depart-

ment in effect manifests the "commercialization" and "infrastructuralization" of the economy, its flourishing will be prevalent spatially, which may lead to the weakening of the spatial difference of this department. Development of producer and social services, on the other hand, is subject to both demanding and supplying factors. On the demanding side, the demand for producer and social services increases with the growth of population and per capita GDP. On the supplying side, the development of the producer and social services is subject to the so-called squeezing out effect, i. e. the accounting, law, technical, information processing and even administrative departments are being squeezed out from the enterprise itself for more specialized development (HUANG, 2000). Since both the demanding factor and the supplying factor are spatially different, the consequential spatial difference pattern of the producer and social services will become more evident.

REFERENCES

- HUANG Shao-jun, 2000. *Services and Economic Growth* [M]. Beijing: Economic Science Press, 299 - 301. (in Chinese)
- LI Li-xun, QIU Jian-hua, XU Xue-qiang, 1994. Economic growth and restructuring in Guangdong during last ten years [J]. *Scientia Geographica Sinica*, 14(2): 118 - 126. (in Chinese)
- OUYANG Nan-jiang, 1996. The spatial division of industrial activities in the Pearl River Delta [J]. *Journal of Geography*, 51(1): 44 - 50. (in Chinese)
- XU Xue-qiang, HUANG Dan-na, ZHANG Rong, 1992. On features of town development in the Zhujiang River Delta since 1978 [J]. *Chinese Geographical Science*, 2 (2): 114 - 125.
- XU Xue-qiang, ZHANG Rong, 1995. The industrialization and urbanization of the Pearl River Delta [J]. *Geography and Territorial Research*, 11(1): 1 - 8. (in Chinese)
- XU Xue-qiang, YAN Xiao-pei, XU Yong-jian, 1999. A research on regional difference in Guangdong Province since 1990 [A]. In: YE Shun-zan (eds.). *Regional Integration in Context of One State and Two Systems* [C]. Beijing: Science Press, 67 - 81. (in Chinese)