Industrial spatial structure and evolution of producer service and manufacturing

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Abstract
One of the most popular researches on industrial agglomeration is focusing on the Krugman's theoretical model as called "core - periphery" model. However, during the industrialization of one region, as the agriculture output decrease, it is interesting to investigate whether its spatial industrial structure will be transformed as "core - periphery" model or not. Because of this, this paper aims to study on the Chinese regional spatial industrial change based on the City-level and Firm-level Database of Chinese Yangtze River Delta. With the specific exploratory method of the Spatial Data Analysis, this paper found that the Chinese Yangtze River Delta has evolved into a new "core-periphery" structure, with producer service as the core and manufacturing as the periphery.
Key words: CORE-PERIPHERY, INDUSTRIAL SPATIAL STRUCTURE, PRODUCER SERVICE

Introduction

As the development of globalization and regional integration, metropolitan region has been an important sign of socioeconomic level of a country or a region. The concept of "metropolitan region" was firstly proposed by French economist J. Gottman, which is now widely applied to the analysis of socioeconomic phenomena worldwide. In China, Yangtze River Delta, with Shanghai as its core, is now the most fast developing area, with the largest economic scale and potential among economic circles. Its total import export volume, fiscal income and consumable turnover all rank first in China. With the approval of *Regional Plan of Yangtze River Delta* by the State Council in May 2010, the development orientation is defined as "the important international gateway in Asia-Pacific region, the important global center of modern service and manufacturing industries, the groups of competitive world cities". Therefore, analyzing the spatial structure of industries in Yangtze River Delta and its evolution could be a worthwhile effort to provide an example for other areas in China.

"What is the most prominent geographic feature of economic actives? A brief answer must be centralization." [1] Industrial agglomeration, as one of the important features of economic activities, is an outcome of industry development. In 1999, the new economic geography represented by P. Krugman [2] set up a basic model for industrial agglomeration, namely a "C - P" model with an industrial "core" and an agricultural

"periphery". Now, most models in agglomeration studies are based on Krugman's model. The premise of the model is increasing returns to scale and imperfect competition. Based on the interaction among increasing returns to scale, trade cost and demand, manufacturing becomes the core and squeezes the agriculture out to the periphery. However, in reality, the manufacturing center is usually the most developed area within a region, so producer service, which provides service for manufacturing, would also develop prosperously. As a result, manufacturing industry may gradually be forced out of the center, forming a new producer service "core" and a manufacturing "periphery". This new agglomeration feature has already been common in many economic zones in China.

Plenty of the Studies on this issue carried out by both domestic and foreigner researchers. Michalak, Fairbairn's (1993) [3] early research focusing on the spatial location feature of producer service of Canada. Furthermore, Based by the empirical study of the industrials location of Sweden, Anderson (2004) [4] found a clear tendency of the co-agglomeration between manufacturing industry and producer service. Krenz(2010) [5] studied the relationship between agglomeration of manufacturing industry and producer service of EU. Ellison, Glaeser(1997) [6] held the point that the concentration of one industry cannot be reflected easily by its GINI Index because of the firms scale difference. Therefore, they introduced a new index called E-G Index to investigate the co-agglomeration between two different industries. Kolko(2007) [7] argued that the agglomeration of producer service cannot be simply explained by either spillover or laboring-pool. He proved the phenomena of the co-agglomeration of manufacturing industry and producer service with E-G Index in US.

Z.B, Liu (2005) [8] proved the improvement of the manufacture industry agglomeration by producer service both theoretically and empirically. Z.B, Liu's (2008) [9] further study held the point that the significant for one country's industrial upgrading by developing the producer service. J.J,Chen et.al(2009) [10] study focused on the agglomeration of producer service, they found the key factors which can affect the agglomeration of producer service based on the city-level database in China. D.Q,Xue, et.al's (2011) [11] empirical study focused on the spatial agglomeration of producer service in Xi'an by using Arcgis Software. W,Zhao,et.al(2011) [12] summarized the mechanism of co-agglomeration between manufacture industry and producer service. Their study focused on the trade cost change, and proved the fact of co-agglomeration between manufacture industry and producer service. What's more important, their study also pointed out the new C-P phenomena in China was specifically with producer service as core, and manufacture as periphery.

Previous studies have been concentrated on the manufacturing agglomeration and ignored the new trend. Besides, they used indexes like Herfindahl index, Space Gini coefficient and EG index to reflect agglomeration, which are not sufficient to show the spatial structure of multi-industries agglomeration. Therefore, the present study used ARCGIS to show the statistic result of employment quantity in manufacturing and producer service industries in the 25 cities in Yangtze River Delta, and LISA distribution maps [13] to show the agglomeration features. It also analyzed Shanghai, the core city, in detail to describe the feature of the new "C - P" distribution.

Theoretical model

Traditional economics assumed constant returns to scale and perfect competition at the micro-level. Then Dixit and Stiglitz (1977) [14] in their study *Monopolistic Competition and Optimum of Product Diversity* introduced increasing returns to scale and monopoly competition into the common equilibrium framework. On the basis of their D – S model, Krugman (1991) [15] used Samuelson's "iceberg transport costs" to compare the transport costs and returns to scale and established an endogenous C – P model with a manufacturing "core" and an agricultural "periphery". In this model, as trade costs decrease, the previous equilibrium is broken by the difference between centripetal and centrifugal forces, resulting in a manufacturing core and an agriculture periphery. On the basis of Krugman's model, Venables (1996) [16] proposed a "vertically linked" model, which takes into consideration the reality in European countries that there was lower labor mobility than that in states in the USA. Assuming that there was no labor flow between countries, he proved that among

vertically linked industries, agglomeration could also appear. In Venables' model, the centrifugal force is the difference in wages among regions, and the centripetal force the input-output links. As trade costs decrease, the industries centralize or decentralize based on the weighing of both forces.

Alionso-Villar and Chmorro-Rivas (2001) [17] proposed a new "C – P" model by incorporating Venables' model into Krugman's. It assumes that there are two regions, labors of which are marked as L1 and L2, and three sectors: agriculture, manufacturing and producer service. Agriculture sector is perfect competition, while the other two are monopoly competition with increasing returns to scale. Producer service is the intermediate product of manufacture; in other words, manufacturing and producer service are vertically linked. Labors can flow among three sectors, but not between two regions. The products are marked as r (r=s,i), and j and k represent two regions. $P_{rj}t_{jk}$ is the price of product by j in k. The consumer preference, and the agricultural and manufacturing techniques are the same as those in the "C – P" model and the "vertically linked" model, which shall not be repeated here.

$$U=Z_M^{\beta} Z_A^{1-\beta} \quad (1)$$

$$F(L_A)=aL_A^{\alpha}, \pi_{Aj}=F(L_{Aj})-w_j L_{Aj} \quad (2)$$

$$L_{Aj}^{*}=\left(\frac{w_j}{a\alpha}\right)^{1/(\alpha-1)} \quad (3)$$

$$AL_{ij}^{1-\mu}\left(\sum_S Z_S^{\varepsilon-1/\varepsilon}\right)^{1/(1-\varepsilon)\mu}=f+x_{ij} \quad (4)$$

The new "C – P" model incorporates producer service industry, where there is only labor investment. Presuming that the corporations are knowledge-intensive and the initial investment is knowledge learning, which is information-directed, namely fixed cost. The producing equation is therefore as follows:

$$L_{sj}=f\left[\frac{n_{sj}+\left[K^{\varphi}T^{\psi}\right]n_{sk}}{n_{sj}+n_{sk}}\right]^{-1}+x_{sj}, j,k=1,2 \quad (5)$$

Where L_{sj} is the labor investment in producing x_{sj} units of service S and n_{sj} the number of producer service corporations in region j. The formula in the bracket represents the information a company acquires from local and other areas, where K^{φ} and T^{ψ} are defined as the technical and telecom environments (K^{φ} and $T^{\psi} \in [0,1]$). As is shown in the costs equation, fixed costs changes as the acquired information changes. Since the amount of information is inversely proportional to the distance between corporations, the further a company is away from its information source, the higher the fixed costs will be.

Based on optimization of consumer and the three industries, i.e agricultural, manufacturing and producer service, the following equations can be concluded:

$$L_j^{*}=w_j^{-\mu}\left(p_{sj}\right)^{\mu}\left(f+x_{jj}+x_{jk}\right)(1-\mu) \quad (6)$$

$$L_{sj}^{*}=f\left[\frac{n_{sj}+\left(K_j^{\varphi}+T^{\psi}\right)n_{sk}}{n_{sj}+n_{sk}}\right]^{-1}+x_{jj}+x_{jk} \quad (7)$$

$$L_j=n_{sj}L_{sj}^{*}+n_j L_j^{*}+L_{Aj}^{*}, \quad j=1,2 \quad (8)$$

Where L_j^{*}, L_{SJ}^{*} and L_{Aj}^{*} are the optimal solutions of labor required by manufacturing, producer service and agricultural industries respectively, and L_j is the labor force within region j. The equilibrium is achieved when the market is cleared (both labor and product markets) and no more corporations enter the market.

Methodology

The distinction of manufacturing and producer service in the paper follows the standards in *Standard Industrial Classification (SIC) Codes*. Therefore, producer service industry includes: traffic, transport, storage and post; information transmission, software and information technology service; finance; real estate; tenancy and business services; scientific research and technology service. [18] As for the targeted region, Yangtze River Delta, according to *The Regional Plans of Yangtze River Delta* approved by the State Council in 2010, covers Shanghai and another 24 cities in Jiangsu province and Zhejiang Province. The statistics of labor forces in manufacturing and producer service of the 25 cities are taken from *China City Statistical Yearbook*. The base graph is the vector graph of Yangtze River Delta. The statistics are transformed into spatial data by the division of administrative areas. Specifically, the statistics of Shanghai, the core city, are from Baidu Map (2014), within which the manufacturing and producer service corporations are sorted out according to the above standards. The sorting result is 21,698 corporations in manufacturing industry, and 21,245 in producer service industry.

The present study adopts ESDA (Exploratory Spatial Data Analysis) to analyze the spatial structure of industries. Previously, most studies used Location Entropy (LQ) to show the industrial agglomeration. However, there are problems of LQ. Firstly, no theoretical or empirical evidence is found to define the specific LQ value that means agglomeration. So LQ cannot reflect the independence and importance of statistics; it largely relies on the definition of agglomeration indexes. Secondly, LQ only considers one region. When the region under discussion is spatially related to another region, LQ is not suitable to show the region's agglomeration. Taking the above into consideration, the present paper chose LISA (Local Indicator of Spatial Association) to indicate degree of agglomeration. Two indexes are used to show local spatial autocorrelation: local Moran index and local G index.

(1) Definition of Spatial Weights Matrix: Spatial Weights Matrix indicates the spatial relations between samples. It is usually represented as an n-order symmetrical matrix $W_{n\times n}$ with two variables, where n is the number of spaces and W_{ij} is the spatial relation.

$$\begin{matrix} W_{1,1} & W_{1,2} & \cdots & W_{1,n-1} & W_{1,n} \\ W_{2,1} & W_{2,2} & \cdots & W_{2,n-1} & W_{2,n} \\ \vdots & \vdots & \cdots & \vdots & \vdots \\ W_{n-1,1} & W_{n-1,2} & \cdots & W_{n-1,n-1} & W_{n-1,n} \\ W_{n,1} & W_{n,2} & \cdots & W_{n,n-1} & W_{n,n} \end{matrix}$$

Spatial Weights Matrix can be defined in two ways: by distance or by adjacency. In this paper, it is defined as follows:

W_{ij} =1,when i and j are in adjacency.

W_{ij} =0, when i and j are not in adjacency.

Local Moran index is defined as:

$$I=\frac{\sum_j W_{ij}\left(Z_i-\overline{Z}\right)\left(Z_j-\overline{Z}\right)}{\sum_i\left(Z_i-\overline{Z}\right)^2}$$

Where W_{ij} is spatial weight, Z_i and Z_j are the characteristic values of region i and j, and $\overline{Z}$ is the average value.

(2) Hot spots analysis: local G index, proposed by Ord and Getis (1995), is a local spatial autocorrelation based on distance weight matrix, which can show both high and low value of agglomeration. It is defined as:

$$G_i^*=\frac{\sum_i w_{ij}x_j}{\sum_j x_j}$$

Where w_{ij} is the distance weight between i and j, a standardized representation of local feature.

$$Z\left(G_i^*\right)=\frac{G_i^*-E\left(G_i^*\right)}{\sqrt{Var\left(G_i^*\right)}}$$

When Z is positive and significant, then the G index for i is relatively high. In other words, region I is of high value agglomeration, i.e the hot spot, vice versa.

(3) Spatial interpolation map: Spatial interpolation map transforms statistics of discrete points into connected curved surface.

Since local Moran index presented a large derivation of agglomeration range, the present study took local G index to show local spatial autocorrelation. Inverse Distance Weighted was used to analyze spatial interpolation, with an aim to compare them with hot spots maps.

Industrial spatial structure in Yangtze River Delta and its evolution

(1) Manufacturing and producer service in Yangtze River Delta

To fully display the industrial structure in Yangtze River Delta, the LISA agglomeration maps were created by Arcgis. Based on G value, 10 degrees were presented by 10 colors in the maps, with three darkest ones as the hot spots.

Figure 1 shows the hot spots of agglomeration of manufacturing and producer service industries in Yangtze River Delta from 2004 to 2013.

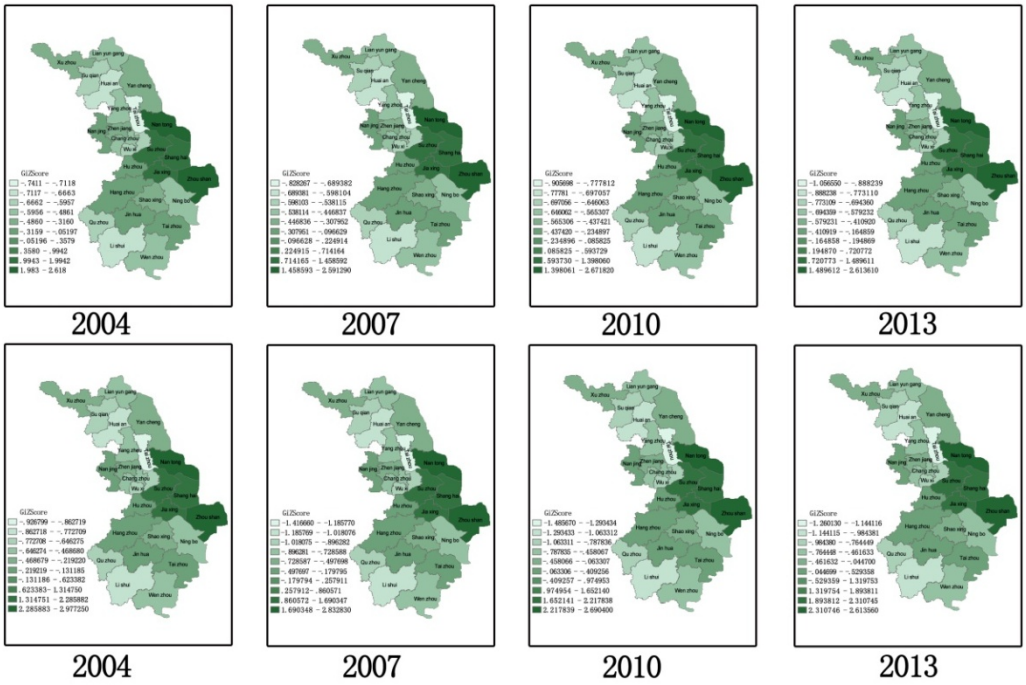

Figure 1. hot spot of manufacturing and producer service industries

Manufacturing industry: In 2004, three regions had the largest agglomeration (Shanghai, Zhoushan and Nantong) and two regions were next to them (Suzhou, Jaixing). In 2007, five regions were found to be the most agglomerated (Shanghai, Suzhou, Jiaxing, Zhoushan and Nantong) and three regions were added to the second place (Huzhou, Shaoxing and Taizhou). In 2010, three regions stood out as the hot spots of agglomeration (Shanghai, Jiaxing and Nantong) and five regions were next to them (Suzhou, Zhoushan, Huzhou, Shaoxing and Taizhou). In 2013, three regions stood out (Nantong, Jiaxing and Zhoushan) and four were next to them (Shanghai, Suzhou, Huzhou and Taizhou).

Producer service industry: In 2004, two regions had the largest agglomeration (Zhoushan and Nantong) and three regions ranked in the second place (Suzhou, Jiaxing and Shanghai). Six more cities were found to be agglomerated with producer service (Xuzhou, Nanjing, Hangzhou, Jinhua, Huzhou and Taizhou). In 2007, four regions showed the highest agglomeration (Shanghai, Nantong, Zhoushan and Jiaxing) and five regions ranked in the second place (Suzhou, Xuzhou, Nanjing, Hangzhou and Jinhua). In 2010, four regions were found to show the highest agglomeration (Shanghai, Nantong, Suzhou and Jiaxing) and Hangzhou which ranked in the second place started to be more and more agglomerated. In 2013, the most agglomerated regions remained the same, while Jinhua were added to the second place.

In general, the manufacturing core is Shanghai, radiating surrounding regions like Nantong, Suzhou, Jiaxing, Huzhou and Taizhou. From 2004 to 2013, manufacturing industry in Shanghai gradually moved out, whereas producer service industry just moved in an opposite direction. Within the decade, Shanghai became the largest place for producer service in Yangtze River Delta. The spatial structure of Shanghai just proved that corporations in the two industries were vertically linked, with producer service in the upstream providing service and intermediate product for manufacturing industry. At beginning, Yangtze River Delta was in industrialized phrase, as the more developed the manufacturing is, the better the economy would be. As region economy developed, manufacturing industry gained more and more weight, resulting in an agglomeration of manufacturing corporations. As the provider of intermediate product for manufacturing, producer service also developed. Gradually, the center of development changed from manufacturing to producer service.

The industrial evolution in Yangtze River Delta can be divided into two phases: the

first phase is single centered. At the initial stage, Shanghai possessed the best industrial bases, transport infrastructure, natural resources, labor resources and market, among all cities in the area. Therefore, factors of production aggregating in Shanghai, Shanghai became the core of industries. The second phase is multi centered. As industry expanded, provincial capitals like Nanjing and Hangzhou also quickly developed into agglomeration hot spots, with support of provincial policies and resources.

Figure 2 demonstrates the spatial interpolation maps of manufacturing and producer service industries according to the employment volume. From the maps, it can be clearly seen that manufacturing centers in Shanghai and the sub-centers are Nanjing, Hangzhou and Ningbo. As for producer service, the core is Shanghai and the sub-center is Hangzhou. Since ancient times, Hangzhou has always been famous for travel, which provides a good base for producer service. Now Hangzhou is also the city of e-commence. That is the main reason why Hangzhou ranks just next to Shanghai in terms of producer service industry.

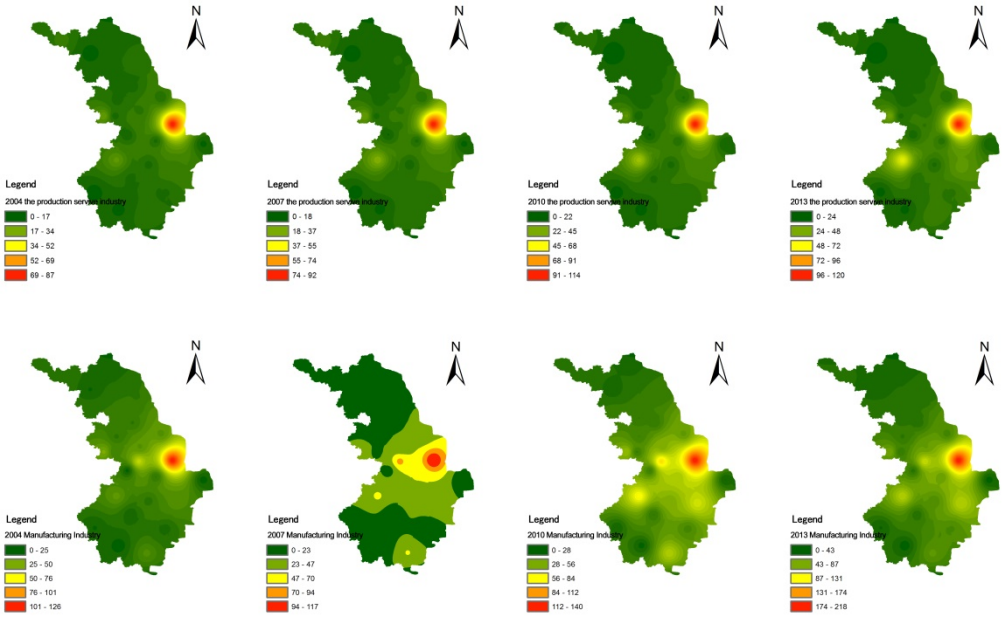

Figure 2. Interpolation maps of manufacturing and producer service industries

(2) Manufacturing and producer service in Shanghai

Previously, most studies on industrial structure have researched on a large region or region with prominent agglomeration by a series of indexes to show the agglomeration of industry. However, how can the agglomeration in a small region such as a city be measured?

Shanghai, as the economic center of China, is the core city in Yangtze River Delta. As an international metropolis, Shanghai cannot be described as the agglomeration area for one single industry. Thus, the industrial structure in Shanghai is geographically coded. On the basis of the results of numbers and locations of manufacturing and producer service industries, the industrial structure is displayed by spatial coding through Arcgis.

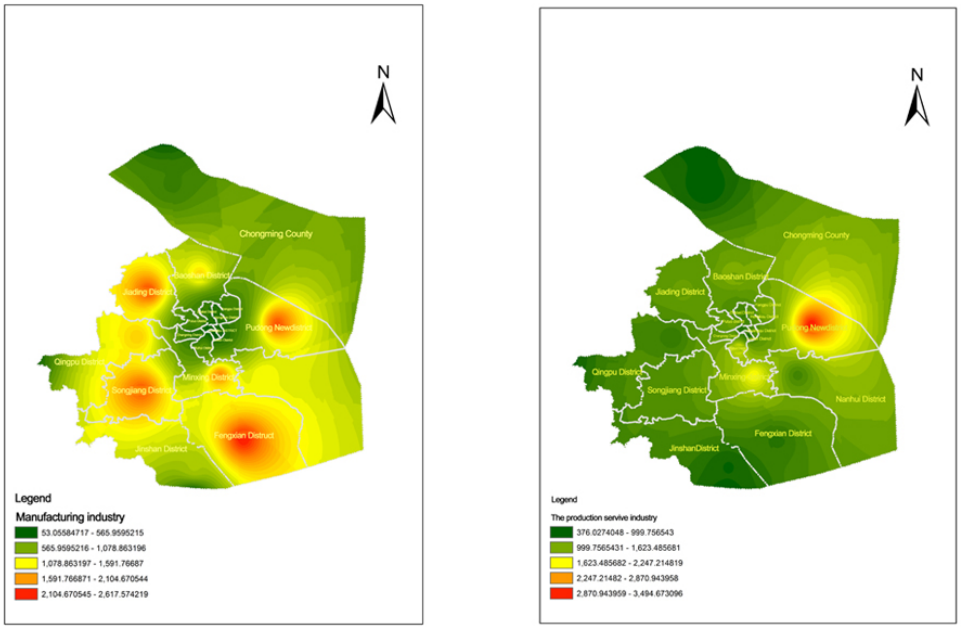

Figure 3. Interpolation maps of Manufacturing and producer service industries in Shanghai

Figure 3 shows the spatial structure of manufacturing and producer service industries in Shanghai on the basis of statistics. It can be seen in the maps that manufacturing industry aggregated mainly in Jiading District, Baoshan District, Pudong New District, Minhang District, Songjiang District and Fengxian District, most of which are the peripheral areas of CBD, while producer service industry in Xuhui District, Pudong New District, Jing'an District, Huangpu District and Luwan District, centering around Xuhui District, Huangpu New District and Minhang District. Up to now, there are seven CBDs in Shanghai, includingLujiazui, Xujiahui, Haihai Middle Road, central area of the People's Square, Hongqiao, Nanjing West Road, and NewJiangwan in Wujiao Chang. Other than Lujiazui, which is in Pudong District, the rest CBDs basically distribute in Xuhui District, Huangpu District, Luwan District, Hongkou District, Yangpu District and Jing'an District. As shown in the maps, Pudong is the largest agglomeration center of producer service. The major contribution is from Lujiazui, an internationally famous financial center, aggregated by numerous banks, financial institutes, transnational corporations and intermediary service organizations. Another center, Xuhui is benefited both from Huaihai Middle Road, with the large amount of office buildings, and Xujiahui, with its convenient transportation. As for Minhang, positioned as the extended area of the central, it is aggregated with industrial zones and space industry on the foundation of Hongqiao Transportation Hub. In addition, support from Shanghai Jiao Tong University, East China Normal University, International Research Center and Economic and Technological Development Zone in recent years, promotes Minhang's transformation to a center for high-tech and modern service. As a result, Minhang now ranks as the third agglomeration center of producer service after Xujiahui and Lijiazui.

On the whole, it can be seen that the spatial structure of a "producer service" core and "manufacturing" periphery in Shanghai is formed. Due to the rapid development of transportation network and high costs of land, manufacturing industry has now withdrawn from the CBDs of Shanghai, spreading in districts around the center, such as Jiading, Minhang, Baoshan, Pudong, Songjiang and Fengxian, whereas producer service is now agglomerating in CBDs due to the

development of transportation and electro-communication networks.

Conclusions and suggestions

Conclusions

In recent years, there have been many discussions in China about spatial structure of industries in terms of its forming mechanism or empirical evidence. However, most of them ignored the new form of a producer service "core" and manufacturing "periphery". Research into it would provide benefits for coordination of regional economic development, transforming of industry structure and development of functional city.

The present paper conducted a spatial statistical analysis of the new C-P form in the metropolitan area in Yangtze River Delta, both empirically and theoretically. It is found that within the whole region, five cities, Shanghai, Nanjing, Hangzhou, Ningbo and Suzhou, stand out as the agglomeration centers for both manufacturing and producer service industries. As a core city in the region, Shanghai is not only the leading city for manufacturing, but also the center for producer service industry, as is shown from the analysis of its industrial structure. The second and third biggest cities in the region, Nanjing and Hangzhou, both as the provincial capitals, play an irreplaceable role in economic development of respective provinces, thus are destined to become the economic centers with resource and policy support. As for Suzhou and Ningbo, they both become the centers on the basis of their own advantages: the former as the base of electronics information industry and the latter as an important port city.

As is shown by the analysis of the spatial structure in Shanghai, when manufacturing industry agglomerates, producer service industry, the service provider for manufacturing, will also develop rapidly. As transportation and electro-communication networks develop, producer service will gradually squeeze manufacturing out to the peripheral areas and take over the central areas itself. Therefore, in Yangtze River Delta there are one center and four sub-centers, with each center having a producer service core and a manufacturing periphery and other satellite cities.

（2）**Policy suggestions**

When making development plan, local government should take into consideration the spatial structure of industries in city. With the fact of producer service core and a manufacturing periphery, the concept of "manufacturing as the key of developing" is not suitable any more. In cities like Beijing, Shanghai and Guangzhou, where the new spatial distribution is already established, local government should put more emphasis on producer service as its economic core. However, in some middle or small sized cities, manufacturing agglomerates in central area and producer service is still in its infancy. The development plan should focus on manufacturing agglomeration, with an aim to promote agglomeration of producer service. Besides, the development of producer service will in turn help the upgrading of manufacturing. When manufacturing industry upgrades, relevant techniques, information and labor forces are required to aggregate, which are usually provided by producer service industry? Therefore, it is necessary to promote the agglomeration of producer service so as to promote the manufacturing upgrade, and to contribute to economic development of the city.

The new "C-P" structure is of significant benefits in city spatial structure modeling and functional transformation. The agglomeration of producer service in the center changes the traditional manufacturing center into a modern service center. As rent costs of the central area increase, producer service gradually spreads into peripheral areas, resulting in a multi-center structure. When producer service occupies the core, the role of city also changes into a service provider. In China, metropolitan areas of Beijing, Shanghai and Guangzhou have formed the spatial structure of a producer service center, while other regions still have a manufacturing core, the difference of which leads to an imbalance between regions. In coastal regions in the East, efficiency and competitiveness of manufacturing industry in peripheral cities is largely promoted and radiated by producer service in core cities, thus accelerating the economic development of the whole region. Accordingly, the Middle and West regions should provide support for producer service in core cities to promote the formation of the new "C-P" structure and thus a functional transformation of cities.

References

1. Krugman P R.（2000）*Geography and Trade*. Beijing University Press: Beijing.
2. Fujita M, Krugman P. R, Venables A .J.(2005) *The Spatial Economy: Cities, Regions, and International Trade*, China Renmin University Press: Beijing.
3. Andersson M.(2004) Co-location of manufacturing & producer services–a simultaneous equations approach. *Working Paper Series in Economics and Institutions of Innovation from Royal Institute of Technology*.
4. Michalak, Wieslawz, Kenneth J. Fairbairn (1993) The location of producer services in Edmonton. *The Canadian Geographer/Le Geographe canadien*, l37(1), p.p. 2-16.
5. Krenz A. (2010) Services sectors' agglomeration and its interdependence with industrial agglomeration in the European Union.*Center for European, Governance and Economic Development Research Working Paper*, no.107.
6. Ellison G, Glaeser E L.(1997) Geographic Concentration in US Manufacturing Industries: A Dartboard Approach. *Journal of Political Economy*, 1997, 105(5).
7. Kolko J.(2007) Urbanization, Agglomeration, and Coagglomeration of Service Industries. *MPRA Paperfrom University Library of Munich, Germany*.
8. Chuansheng Gao, Zhibiao Liu (2005) Producer Services & Convergences and Development of Manufacturing Industry in Yangtze River Delta--Theoretical, Empirical and Potential Analysis. *Shanghai Economic Review*, No.8, p.p.35-42.
9. Zhibiao Liu. (2008) Producer service industry and cluster: the key factors to climb up the global value chain and the mechanism for realization. *Economic Issues in China*, No.1, p.p.3-12.
10. Jianjun Chen, Guoliang Chen, Jie Huang (2009) A Study, Based on the Theory of the New Economic Geography, on the Agglomeration of the Services that ServeProduction and its Influential Factors. *Management World*, No.4, p.p.83-95.
11. Dongqian Xue, Ning Shi, Xiaoxiao Gong.(2011)Spatial Features and Agglomeration of Producer Services in Xian City, China. *Scientia Geographica Sinica*, 31(10), p.p.1195-1201.
12. Wei Zhao, Wenwen Zheng.(2011)Producer services-trade cost and manufacturing clusters: Mechanism and empirical study. *Economist*, No.2, p.p.67-75.
13. 13.Allison L.(1995) Local indicator of spatial association. *Geographical Analysis*, 27(2), pp.93-115.
14. Dixit A K, Stiglitz J E. (1977) Monopolistic Competition and Optimum Product Diversity. *The American Economic Review*, 67(3), p.p. 297-308.
15. Krugman P. (1991) Increasing Returns and Economic Geography. *The Journal of Political Economy*, 99(3), p.p.483-499.
16. Venables A J.(1996) Equilibrium Location of Vertically Linked Industries. *International Economic Review*, 37(2), p.p.341-359.
17. Olga Alionso-Villar, Jose-Maria Chmorro-Rivas. (2001)How Do Producer Services Affect the Location of Manufacturing Firms? The Role of Information Accessibility.*Environment and Planning*, 33(9), p.p.1621-1642.
18. JianjunChen,Jingjing Chen.(2011) The Research on the Co-location between Producer Services and Manufacturing–The Empirical Analyses Based on the 69 Cities and Regions inZhejiang Province.*China Industrial Economics*, No.6, p.p.141-150.