

Analysis of the Temporal and Spatial Evolution of the Differences in the Development of Producer Services

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Abstract: According to China's 31 provinces as the observation unit, the factors that influence the development of clarity and recognition of the "new normal" economic model of the producer services, combined with the related data of 2001~2015 years of productive service industry development level and economic development of the spatial temporal evolution characteristic analysis, study found that the development of different provinces under production the service industry has great difference, the productive service industry service efficiency of Gene coefficient is the overall volatility of the rising trend; the whole provincial production service industry service efficiency with spatial positive correlation, showing obvious characteristics of spatial aggregation. On the basis of considering the influence factors of spatial factors, we find that factors such as regional economic level, industrialization level, specialization division, industrial convergence degree and government intervention degree all have positive effects on the development of producer services.

1. Introduction

With the convening of the 18th National Congress of the Communist Party of China, General Secretary Xi Jinping pointed out: "China's development is still in an important period of strategic opportunities, adapting to the new normal, and maintaining a strategic normal heart" ^[1]. Judging the current economic characteristics with the new normal, and raising it to a strategic height, shows the country's deep understanding of the current changes in China's economic stage, especially with the in-depth advancement of national strategies such as the "Belt and Road, China Manufacturing 2025". The producer service industry has become the key to the deep integration of the industry and the transformation of economic development^[2]. Therefore, how to plan and promote the development of productive service industry has become an important part of China's strategic planning ^[3].

Through previous literature research, Fan Xiufeng^[4] analyzed the correlation between production service and manufacturing division based on the value chain perspective, and empirically verified the different factor concentration of different productive services by the influence degree of production efficiency. The role of manufacturing efficiency and the difference in path. The method analyzes the industry aggregation degree of the sub-segment of the service industry, lacks the macro analysis of the development of the production service industry in different provinces, lacks the local consideration of the province, and lacks the analysis of the influence of the relevant spatial factors. Therefore, this paper analyzes the spatial and temporal evolution characteristics of the added value of productive services in different provinces in China's provinces by applying exploratory spatial data analysis (A). At the same time, the geographical weighted regression model combined with spatial features is used to analyze the impact of the development of productive services. Factors, and put forward relevant policy recommendations on the results of the analysis.

2. Research objects and data methods

2.1 Research objects

This study mainly analyzes the clustering of productive service industries in China's provinces, autonomous regions, and municipalities directly under the central government from 2000 to 2015. The research data are derived from the recent China Statistical Yearbook and China Regional Economic Statistical Yearbook and China's Third Industry Statistical Yearbook.

2.2 Data Variable Description

Since the metrics for the development of the producer service industry have not always had a clearly defined indicator, many research scholars have chosen a comparative study on one aspect or a certain aspect of the producer service industry, and there has never been an indicator standard that can reach consensus. At the same time, in the "China Statistical Yearbook" and "China Regional Economic Statistical Yearbook", there is no direct representation of the development level of China's provincial production service industry. Through the previous literature research, this paper will provide service efficiency in the production service industry. As a data indicator to measure the level of productive service industry, the service efficiency of productive service industry is measured by the ratio of the added value of provincial production service industry to GDP and the proportion of productive service employment to total employment.

2.3 Spatial Econometric Model

2.3.1 Exploratory spatial data analysis model

Exploratory spatial data analysis model is a data analysis technique that combines statistical analysis with the spatial distribution of graphs. It uses ESDA (Exploratory Spatial Data Analysis) method to describe the development space of productive services in different provinces in China. Characteristics and its impact on the local area, this study uses the index to study the spatial autocorrelation of the development of the provincial production service industry, and based on this, select the local indicators and LISA in the ESDA. The (Local Indicators of Spatial Association) aggregation graph analyzes the high and low local spatial aggregation of observations, and can also assess the spatial aggregation of provincial production service industry development and reveal different spatial connections.

The basic calculation principle of the global space autocorrelation index is:

$$Moran' I = \frac{\sum_{i=1}^n \sum_{j=1}^m W_{ij} (x_i - \bar{x}) (x_j - \bar{x})}{S^2 \sum_{i=1}^n \sum_{j=1}^m W_{ij}}$$

Among them: $S^2 = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$, $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$, It is a standardized spatial neighboring weight matrix,

which corresponds to the total value in ownership, and is the total number of selected indicator regions. In this paper, we use the first-order weight matrix based on the common boundary when studying the spatial evolution difference of the development of each province's productive service industry. The area is adjacent to the area; if the area is not adjacent to the area, then. The Moran index is used to measure the similarity of the values of the variables in the survey. At that time, the value of the variable shows a spatial similarity; when it appears as a variable, there is no agglomeration; when it is approximated, it means that the value of the variable obeys a random distribution in the spatial distribution. The local spatial autocorrelation analysis of the provincial production service industry development is carried out by analyzing and measuring the spatial association bureau indicator clustering graph.

2.3.2 OLS linear regression model

Through the factors affecting the service efficiency of the production services in different provinces, it is first necessary to carry out spatial autocorrelation analysis. If there is spatial autocorrelation, the variables have spatial distribution characteristics. Through the regression model analysis of OLS, the construction of the model can be found to lack the consideration of spatial factors. The conclusions obtained from the model establishment lack the consideration of spatial factors. Therefore, considering the local feature weights based on the spatial econometric theory and method, the positional function of the observed data is included in the regression coefficient of the model. Combined with the EVIEWS6.0 application, it more intuitively and accurately reflects the spatial dependence of the relevant influencing factors of the productive service. Sex and heterogeneity.

2.3.3 Geographically Weighted Regression Model GWR Analysis

GWR analysis is a research method for analyzing spatial heterogeneous processes. The GWR calculation model for geographically weighted regression models is:

$$y_i = \beta_0(u_i, v_i) + \sum_{j=1}^n \beta_j(u_i, v_i) x_{ij} + \varepsilon_i$$

Where: and indicate the geographic location coordinates of the first location, indicating the random error at the first location. The relationship between and will vary with geographic location. The core types that can be selected in the GWR module of ArcGIS are mainly fixed space cores and adaptive space cores. When the adaptive spatial kernel compares the fixed space kernel, the data sample point dense area has smaller bandwidth, and the sample sparse area has larger bandwidth, thus achieving a better fitting degree. The GWR model allows local parameter estimation and spatial difference of data. Qualitative inclusion in the model creates conditions for the characteristics of the regression relationship.

3. Spatial evolution characteristics of service efficiency of provincial production industry in China

3.1 China's provincial production service industry added value accounted for the numerical spatial distribution of GDP

With the advent of the “new normal” economic model, especially with the deepening of national strategies such as “One Belt and One Road” and “Made in China 2025”, the producer service industry has become an important key to accelerate the integration and coordinated development of the three industries. The development trend has gradually shifted from “industrial economy” to “service economy”.

The data in Table 1 shows that the added value of GDP in China's coastal provinces is relatively higher than that of inland cities, indicating that the production activities in the coastal provinces are the most frequent, from 2001 to 2015. The relatively stable spatial and temporal evolution characteristics; the development activities of different provinces' productive service industries are mainly distributed in the central part of China, and the northeastern region mainly shows a relatively obvious slowing trend in Liaoning, and the central regions are like Henan, Chongqing and other provinces. The aggregation of service development has been increasing rapidly with the passage of time, and at the same time it has shown a trend of spreading to the periphery in the geographical range.

Table 1 Value-added ratio and ranking of added value of productive services in different provinces

Province	2001~2003		2007~2009		2013~2015		Average annual growth rate(%)
	Numerical value	Ranking	Numerical value	Ranking	Numerical value	Ranking	
Beijing	2967.78	6	8263.70	5	16769.13	5	14.25
Tianjin	1009.86	18	2847.28	17	7799.98	14	16.42
Hebei	2165.25	8	5315.02	7	11073.25	12	13.03
Shanxi	1023.92	17	2634.79	19	5926.31	21	14.4
Inner Mongolia	837.17	24	3125.37	15	6824.24	17	10.83
Liaoning	2264.70	7	5195.24	8	12077.44	8	10.25
Jilin	964.37	21	2397.99	21	5053.79	24	13.12
Heilongjiang	1322.83	15	2923.56	16	6889.94	16	12.26
Shanghai	3057.34	5	7874.73	6	15361.27	6	16.98
Jiangsu	3946.71	2	11749.50	2	30627.60	2	16.48
Zhejiang	3261.49	4	8777.18	4	19503.81	4	14.87
Anhui	1422.83	14	3228.86	14	7517.64	15	13.84
Fujian	1777.98	13	4388.30	13	9662.39	13	12.49
Jiangxi	966.46	19	2303.96	22	5810.29	22	14.27
Shandong	3697.49	3	10249.02	3	25866.33	3	15.51
Henan	2041.82	9	5104.21	9	13104.20	7	15.17
Hubei	1804.33	11	4468.77	12	11353.88	10	14.76
Hunan	1789.97	12	4623.96	10	11414.56	9	14.88
Guangdong	6355.74	1	16150.29	1	33526.73	1	13.46
Guangxi	1061.64	16	2535.13	20	5960.86	20	13.85
Hainan	271.12	28	640.30	28	1810.53	28	14.81
Chongqing	959.16	22	2153.38	24	6712.85	18	15.71
Sichuan	1957.72	10	4547.36	11	11240.76	11	14.42
Guizhou	488.00	27	1617.02	25	4218.26	25	17.39
Yunnan	918.03	23	2211.74	23	5574.09	23	14.32
Tibet	85.32	31	215.86	31	494.19	31	14.8
Shaanxi	965.23	20	2673.89	18	6574.00	19	15.29
Gansu	521.36	26	1211.53	27	3030.57	27	14.14
Qinghai	149.65	30	349.79	30	873.32	30	14.56
Ningxia	172.83	29	468.31	29	1198.48	29	12.35
Xinjiang	695.99	25	1418.66	26	3796.45	26	13.43

3.2 The Gini coefficient of provincial science and technology transfer education expenditures in local provinces fluctuated

Through the location Gini coefficient, the provincial disparity of science and technology transfer education expenditures of local universities in 31 provinces and cities in the 10 years from 2001 to 2015 was analyzed [18-19]. The location Gini coefficient model is as follows:

$$G = \frac{1}{2n^2x} \sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|$$

Variable description: For the Gini coefficient, it represents the average value of science and technology transfer funds of provincial universities, and is the number of provincial administrative units. The Gini coefficient ranges from 0 to 1. The higher the coefficient, the larger the gap between provinces and the larger the aggregation value. The lower the coefficient, the smaller the gap between the provincial and western universities' science and technology transfer education expenditures. At 0 o'clock, the expenditures on science and technology transfer education on behalf of provincial and local universities are completely equal.

From 2001 to 2015, the trend analysis of the location Gini coefficient of the degree of development of China's provincial productive services can find that the overall Gini coefficient of

the location is fluctuating, and the innovation activities of 31 provinces show a fairly high level of spatial concentration, and this concentration The degree has shown a relatively stable growth trend in the past 15 years, which means that there is no sign of convergence in provincial production service development activities, and on the contrary, it shows a certain degree of self-reinforcement and cumulative causality. This is similar to Gillespie's research on the geographical evolution of the UK's producer services industry. At the same time, the change in the concentration index of the development level of the producer service industry from 2001 to 2015 continued to increase from 0.143 to 0.197, and a large part of the development of China's producer service industry gradually became concentrated in the first-tier developed cities, and over time. In the future, there will be a constantly evolving trend in the future.

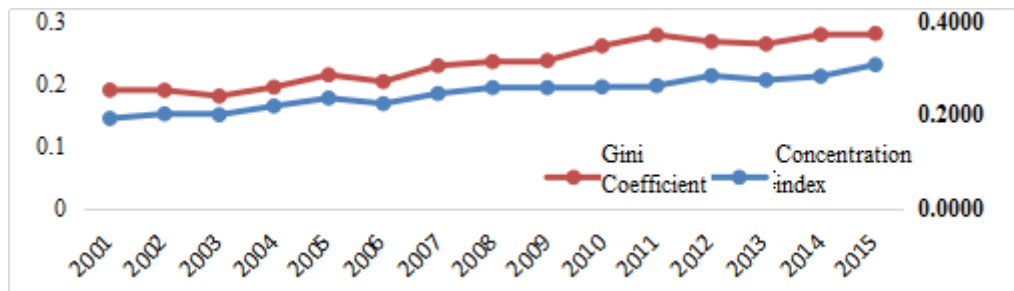


Figure 1 Trends in Gini Coefficient and Concentration of Service Efficiency in China's Provincial Producer Services from 2001 to 2015

3.3 Provincial productivity service industry service efficiency spatial agglomeration extension

Based on the research of location Gini coefficient, combined with the function of spatial autocorrelation analysis of software, the spatial weight matrix is established. The spatial autocorrelation of 31 provinces' productive service efficiency is carried out by using the global spatial autocorrelation-index. Statistical tests to detect the correlation of attribute values between spatial units.

The index values of the service efficiency of the provincial production service industry are shown in Table 2.

Table 2 Provincial Local Productive Service Industry Service Efficiency Value Index Value

Years	<i>Moran's I</i>	Years	<i>Moran's I</i>	Years	<i>Moran's I</i>
2001	-0.127249	2006	-0.131976	2011	-0.080044
2002	-0.124367	2007	-0.130680	2012	-0.081205
2003	-0.125964	2008	-0.135703	2013	-0.108509
2004	-0.145404	2009	-0.110545	2014	-0.094181
2005	-0.145224	2010	-0.080451	2015	-0.076857

Through further analysis of the trend of the provincial local productive service industry service efficiency index from 2001 to 2015, it is found that the spatial clustering of provincial local productive service industry service efficiency is further strengthened, which indicates that China's provincial local production service industry The spatial imbalance of service efficiency is intensifying, and the index change trend of service efficiency in productive service industry is shown in Figure 2.



Figure 2 Service efficiency value of provincial local productive service industry from 2001 to 2015

Through the analysis of the index change trend of the province's productive service industry service efficiency from 2004 to 2015, the trend of the service efficiency index of the provincial production service industry in recent years is shown in Figure 2. The results show that the provincial production service industry. The spatial aggregation of service efficiency values is further strengthened, and the imbalance in spatial aggregation is increasing.

4. Visualization Analysis of Spatial Aggregation of Service Efficiency Values of Provincial Local Producer Services

Through the index, the spatial correlation of the whole can be analyzed, but it is difficult to accurately reflect the spatial agglomeration of provincial local productive service industry service efficiency in local areas. Therefore, it is based on the form of agglomeration map and the local local productive service industry. The spatial agglomeration law of efficiency is visually analyzed.

Through the analysis and consolidation of the spatial agglomeration status of the service efficiency value of the local production service industry in 31 provinces in China, as shown in Figure 2. Where: "H" means High and "L" means Low. Both L-L and L-L indicate positive local spatial autocorrelation, indicating local high-value space aggregation of service efficiency in service industries, indicating low-value space aggregation of local productive service industry service efficiency; and expressed as spatial out-group, ie, negative local area Spatial autocorrelation.

Table 3 Spatial aggregation related table of service efficiency of provincial local production service industry

Years	<i>H-H</i>	<i>H-L</i>	<i>L-L</i>	<i>L-H</i>	No correlation	Neighborless
2001	Fujian	No	Tibet	No	Other	Hainan
2002	Fujian	No	Xinjiang	No	Other	Hainan
2003	Fujian	No	Xinjiang,Tibet	No	Other	Hainan
2004	Fujian	No	Tibet	No	Other	Hainan
2005	Fujian ,Shanghai	No	Tibet,Qinghai	No	Other	Hainan
2006	Fujian ,Shanghai	No	Tibet	No	Other	Hainan
2007	Fujian ,Shanghai	Gansu	Tibet	No	Other	Hainan
2008	Fujian	Gansu	Tibet,Qinghai	No	Other	Hainan
2009	Fujian ,Shanghai	No	Tibet,Qinghai	No	Other	Hainan
2010	Fujian ,Beijing	No	Tibet	No	Other	Hainan
2011	Fujian	Gansu	Tibet,Liaoning	No	Other	Hainan
2012	Fujian	Gansu	Tibet,Liaoning	No	Other	Hainan
2013	Fujian	Gansu	Tibet,Qinghai,Liaoning	No	Other	Hainan
2014	Fujian ,Shanghai	Gansu	Tibet,Qinghai,Liaoning	No	Other	Hainan
2015	Fujian ,Shanghai	Gansu	Tibet,Qinghai,Liaoning	No	Other	Hainan

The areas marked in the above table have passed the significance test. According to the data analysis in Table 3 above, only the two provinces (cities) in Fujian and the two provinces (cities) in Shanghai in the past 15 years are located in the area, indicating that these two The provinces (cities) belong to the regions with high service efficiency in the local productive service industry; at the same time, there are more provinces (municipalities) located in the region relative to other regions. According to the data of the chart, the surrounding provinces such as Tibet, Qinghai and Liaoning belong to Areas where provincial productive services are less efficient.

5. Analysis of the influencing factors of service efficiency changes in provincial production service industry

5.1 Variable Description

Based on the analysis of the service efficiency aggregation of the provincial production service industry, this study analyzes the influencing factors that can affect the service efficiency change, and combines the analysis of the influencing factors of the existing literature on the development of the producer service industry, so select the regional economic level. Indicators such as specialized division of labor, degree of industrialization, degree of industrial integration, degree of government intervention, and investment in science and technology funds in colleges and universities are used as independent variables affecting the changes in service efficiency of provincial productive service industries. Since many indicators do not directly reflect the data in the statistical yearbook, the specialization index of labor accounts for the proportion of industrial added value to the total industrial output value; the degree of industrialization indicators refers to the proportion of the added value of the secondary industry to GDP, and the province for industrial integration The level of regional information technology indicates that the degree of economic intervention is measured by the ratio of government consumption to final consumption.

5.2 OLS analysis

By constructing the OLS linear regression model, it is possible to analyze the impact of different variable influencing factors on the service efficiency changes of provincial local producer services. Combined with the statistical analysis function, the specific analysis results based on the least squares model parameter estimation are shown in Table 4.

Table 4 Parameter Estimation and Test Results of Least Squares Method Model

Variable	Coefficient	Standard deviation	T-test	Probability
Regional economic level	1374803	244731.6	5.617592	0.0001
Specialized division of labor	45324.02	4344.973	10.43137	0.0000
Degree of industrialization	542630.5	124562.6	4.356289	0.0008
Industrial integration	1268.101	68.859	18.41585	0.0000
Degree of government intervention	271351.5	58323.10	4.652557	0.0005
University science and technology funding	42480706	74213785	0.572410	0.5768

Through the test of the values, it is found that the five factors affecting the regional economic level, the specialized division of labor, the degree of industrialization, the degree of industrial integration, and the degree of government intervention have passed the test, indicating that the service efficiency of the provincial local production service industry changes and the five factors passed the test. Correlation and cut have positive correlation, and the R2 of the regression model is 0.546, while the investment factors of science and technology funds in colleges and universities have not passed the test.

5.3 GWR Geographically Weighted Regression Analysis

When analyzing the influencing factors of OLS model on the service efficiency change of provincial local producer service industry, there is no consideration of the influence of spatial factors on the service efficiency change of provincial local production service industry. Therefore, it is necessary to establish a spatial model coefficient to supplement the The impact analysis of spatial factors, so the establishment of a geographically weighted regression model - model for analysis, the calculation results are shown in Table 5.

Table 5 Parameter estimation and test results of geographically weighted regression model

Model parameter	Numerical result
bandwidth	1.168
Sum of residuals	2541909
Effective number	17.490
Degree of freedom	1.047
Akaike Information guidelines	26.673
Related parameters	0.574

From the parameter estimation and test results of the geographically weighted regression model, the proposed full-featuredness of the geo-weighted model is 0.574, which is slightly lower than the goodness of fit of the OLS regression.

The data is integrated into the regression coefficients of the geographically weighted regression model, as shown in Table 6 below.

Table 6 GWR geographically weighted regression model coefficient statistical analysis table

Influencing factor	average value	Maximize	Minimum value	Upper quartile	Lower quartile value	Median value
intercept	-6384.9	23254.80	-103219.20	1839.21	-6802.15	-4575.82
Regional economic level	2.452	8.909	-4.051	3.295	0.597	2.755
Specialized division of labor	0.585	9.824	-4.210	1.721	-1.721	-0.041
Degree of industrialization	1.430	4.797	-2.025	2.647	0.322	1.483
Industrial integration	0.553	4.802	-2.479	1.096	0.164	0.339
Degree of government intervention	1.823	5.700	-3.099	2.815	1.155	2.013
University science and technology funding	-0.241	1.496	-1.757	0.059	-0.449	-0.358

The results show that, among the regression coefficients of the respective variables, except for the investment factors of science and technology transfer in colleges and universities, the other independent variables are all positive values, so it can further explain the regional economic level, specialization division, industrialization degree, industrial integration degree and government intervention. The degree and other indicators have a positive impact on the service efficiency of local provincial producer services.

6. Summary

1) Through the analysis of the spatial evolution characteristics of the service efficiency changes of the local provinces in 31 provinces, from 2001 to 2015, the amount and intensity of service efficiency of local production services in all provinces have been greatly improved. Some provinces such as Shanghai and Jiangsu still maintain a high-speed growth trend, while the growth trends of some provinces such as Inner Mongolia and Liaoning are gradually gradual, and the difference in growth rate brings about the spatial evolution of the development of productive services.

2) Combined with the results of statistical analysis, it provides evidence of significant autocorrelation in the service efficiency of local provincial producer services. During the inspection period, the service efficiency changes of local production services in different provinces showed a

trend of agglomeration. Over time, this spatial autocorrelation and agglomeration show an intensifying trend, which reflects to some extent the spatial limitations of the spillover of service efficiency in different provinces.

3) The spillover of service efficiency changes in local provinces' productive services industry depends to some extent on spatial proximity. Different provinces are affected by factors such as location conditions, capital investment and policy implementation environment, resulting in provincial local productive service industries. Service efficiency presents differences. At the same time, combined with the analysis results, the development degree of China's provincial productive service industry has been tested in the regional economic level, specialized division of labor, degree of industrialization, degree of industrial integration, and degree of government intervention. The performance is related to the development of productive service industry, which is the impact. Important factors for the difference in service efficiency of local production service industries in different provinces.

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