

Analysis on the Influencing Factors of the Competitiveness of Information Service Industry based on OLS Regression and Big Data Platform

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Abstract

Under the background of information globalization, the information industry has become the most active factor to improve the comprehensive national strength and the development of the national economy and social information. Information service industry, as an important component of the high-tech service industry in Beijing, has obvious advantages in the scale of the industry, the strength of the enterprise, innovation and so on. Using location quotient evaluation method and index analysis, we analyze the current situation of Beijing information service industry competitiveness, at the same time; we analyze the factors that affect the competitiveness of information service industry by using expanding trade gravity model. The research results show that the influencing factors include the regional economic development level, the investment scale of the industry, the improvement of the infrastructure construction of the information service industry, the management system and the industrial policy.

Keywords: *Information service industry; competitiveness; influencing factors; gravity model*

1. Introduction

Information service industry is an important part of the information industry, is a high intelligence input, high value-added, high correlation, low material consumption of the pilot strategic industry. 2013 national information service industry's added value of 1.35 trillion, and maintained a growth rate as 14.8%, accounting for 2.3% of gross domestic product. The development of information service industry is the implementation of Scientific Outlook on Development, to achieve the economic structure to promote economic restructuring, an important way to change the mode of economic growth. With the progress of science and technology innovation and business model constantly, the fusion of technology and industry to further deepen, in our country, with the software, digital audio and video as the representative of the information service industry to promote regional economic development, and occupy an increasingly important position. Beijing relies on a wealth of talent, technology, information, and other strategic resources of the market, its development has always been located in the country's leading level. In 2014 the Beijing information service industry GDP reached 208 billion, to maintain a growth rate as 12.4%, accounting for 9.8% of GDP, accounting for 12.5% of the proportion of the third industry, the information technology services revenue far more than Shanghai, Jiangsu, Guangdong and other regions. It plays an important role in supporting the development of the third industry and optimizing the industrial structure of Beijing city.

At present and in the future, Beijing is in the process of moving per capita GDP to the high income level, the city function is also the overall leap, at the same time, the

information service industry market competition is becoming increasingly fierce. However, the overall size of Beijing city in the information service industry is small, the lack of information services, and the imbalance between supply and demand. To enhance the competitiveness of Beijing information service industry, the information service industry to enhance the competitiveness of the factors in the process of system analysis, in order to enhance the competitiveness of the information service industry in Beijing put forward the corresponding countermeasures and suggestions.

2. Development of Information Service Industry in Beijing

2.1. Information services

In the production and distribution of knowledge in the United States, knowledge industry is divided into several sectors, such as education, research and development, communication media, information equipment and information services. The Information Services Department also includes legal services, medical services, financial services, accounting, engineering services, and agency services. The research of information industry in our country is late, but there are many representative results. Such as put information industry into the information technology department, information department and the Department of commercial registration information three departments, is absorbed by the Japanese scholars and Borat's point of view, and innovation. Scholars claimed that the information industry is divided into information technology and equipment manufacturing and information services industry in two sectors. It is worth noting that the traditional information service industry divided into information service industry and modern electronic information services and research scope is as follows: the information service industry including the traditional information service industry and modern electronic information services, including news reports, printing and publishing, library and archives, information, patent standard, postal and telecommunications; the latter contains database industry, information industry, information processing industry, processing industry, software development and system integration services, consulting services.

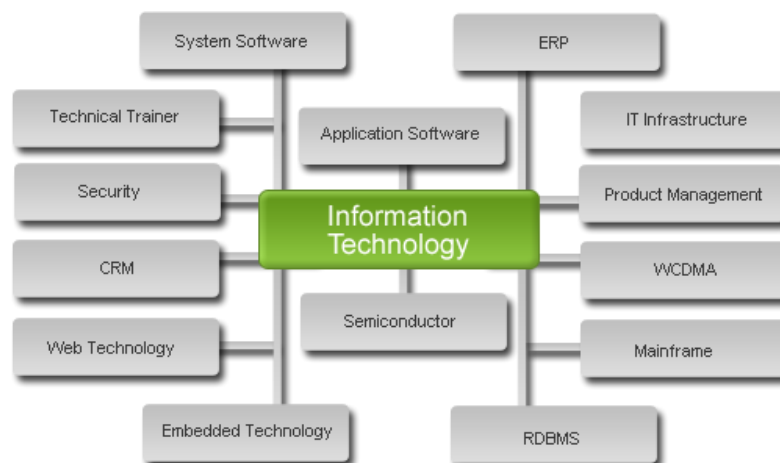


Figure 1. Information services

2.2. The present situation of information service industry in Beijing

Modern information service industry, as an important part of modern service industry, plays an important role in the capital economy. The development of Beijing information service industry cannot do without the inter industry trade, the trade is one of the most direct reflection of industry development, through the analysis of Beijing city information

service trade, we can see that the dynamic development process of an industry. From 2005-2014 China's total exports of information services trade increased by 9.98, with an average annual growth of 18.4%.

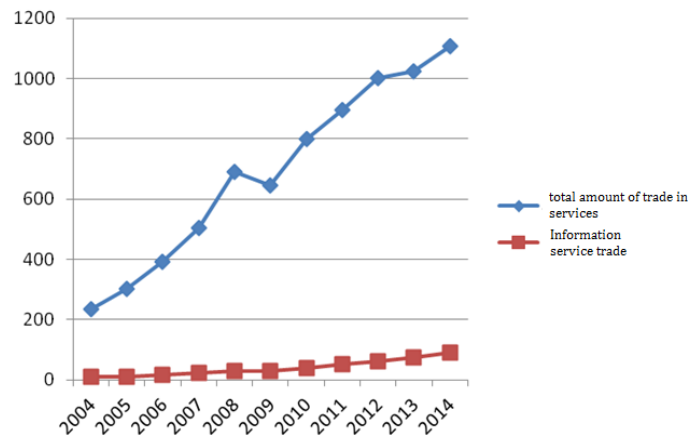


Figure 2. Beijing total trade in services, information services trade

As shown in Figure 2, Beijing's information services trade in the country's overall development driven by showing a growing momentum. According to the Beijing Municipal Bureau of statistics data show that in 2009 the total amount of information services in Beijing City, 2 billion 880 million U.S. dollars, down 1.5% in 2008. With the improvement of the world economy, in 2010, Beijing's total import and export of service trade grew violently, in which the total trade in services in 2012 increased by 11.7% in 2014, the growth rate of information services trade in 20.4%.

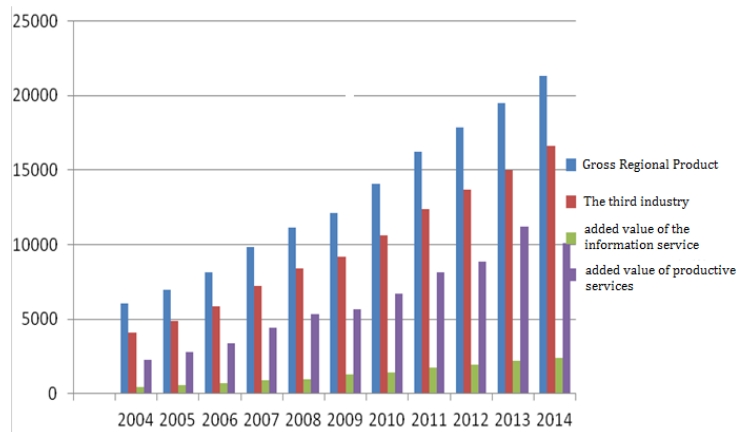


Figure 3. Comparison of the value added of information service industry in Beijing

During the period of 2004-2014, the total import and export volume of information services in Beijing increased 30% over the same period last year, higher than the average annual growth rate of the country. In the recovery of the world economy is not balanced, some industries are relatively weak growth situation, the Beijing information services trade showed a better resistance. Beijing modern information service industry has entered a new stage of optimization, integration and development, into the rapid development of the track. The transmission service industry is becoming mature, the system integration and software service industry has strong development momentum, the electronic commerce is booming, the information resources industry development potential is huge.

Beijing City, the total size of the information service industry continues to grow, the contribution to the Beijing region's GDP increased gradually, see Figure 3. The increase in 2014 Beijing "computer and information service industry value reached 208 billion 200 million yuan, an increase of 16.5%, computer and information services trade amounted to \$3 billion 983 million, ranked third in the third industry, second only to the financial, wholesale and retail trade, increase the information service industry in 2014 GDP accounted for 10%, see Figure 4.

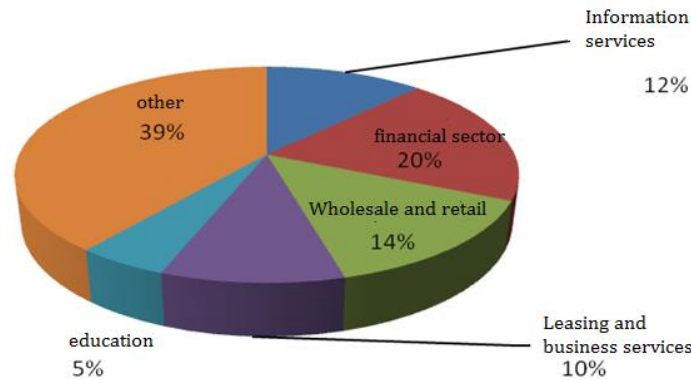


Figure 4. Information service industry to GDP ratio

From Table 1 can be learned that, with the size of the enterprise and the continued growth of personnel, industry revenue and total profit in 2012 exceeded 100 billion mark. But at present, the Beijing information service companies are still not well established problems with industry associations, government, scientific research institutions. Mainly in the field of cooperation to be in-depth, the role of industry associations and alliances need to dig deep, the government's support for the industry's structural imbalance. In addition, the rapid development of many experts and scholars on the research results mentioned many times in the protection of intellectual property rights lag, lag, technical standards for the construction of high-end talent shortage, the information resource development and sharing of the urgent need to improve the problem also restricts the Beijing information service industry, enterprises and Industry associations, government and research institutions "cooperation needs to be strengthened.

Table 1. Beijing information service enterprises above designated size leading economic indicators

	2005	2006	2007	2008	2009
enterprises	1702	2285	2323	2938	2750
practitioners	28.7	29	31.2	34	38
Total revenue	1401.7	1895.6	2428.9	2809.1	3014.9
Total profit	577.6	627.1	632.8	682.6	819.3
	2010	2011	2012	2013	2014
enterprises	2727	2729	2303	2289	2296
practitioners	43	51.3	45.5	47	51.4
Total revenue	3541	4097	3355.6	3401.7	4104.7
Total profit	889	888.5	1084.5	1125.1	1060.5

2.3. Information service industry competitiveness analysis

At present, the most commonly used is the display of comparative advantage index, namely RCA index. The RCA index is not affected by the fluctuation of the total output value, which can well reflect the comparative advantage, trade structure and the change of

the industrial structure of the country or region. But the RCA index has a large defect, that is, intuitive is not strong, it is possible to produce the problem of systematic deviation of the exponential distribution. Therefore, by looking up the literature, the RCA value is processed symmetrically, and the expression is calculated by using the symmetry display comparative advantage index:

$$RSCA = \frac{RCA - 1}{RCA + 1} \quad (1)$$

Table 2. RSCA index value of service trade in Beijing city in 2005-2014

	2005	2006	2007	2008	2009
transport	-0.094	-0.172	-0.174	-0.202	-0.19
Tourism	-0.111	-0.181	-0.16	-0.686	-0.796
financial service	-0.976	-0.972	-0.974	-0.977	0.369
information service	0.167	0.07	0.201	0.094	0.094
	2010	2011	2012	2013	2014
transport	-0.199	-0.219	-0.221	-0.223	-0.224
Tourism	-0.84	0.307	-0.369	-0.374	-0.382
financial service	-0.456	0.358	-0.621	-0.736	0.366
information service	0.152	0.187	0.267	0.3	0.343

The location quotient is the ratio of specific sectors of a region in the area of total output accounted for the proportion of national output and the sector output accounted for in the total output value in the proportion of the distribution of a certain area for measuring elements of the space, reflecting the degree of specialization of a certain industry sector, has important practical significance and a region specific department or industry at a high level in the region's status and function. Its expression is:

$$LQ_{ij} = \frac{L_{ij} / \sum_{j=1}^n L_{ij}}{\sum_{i=1}^n L_{ij} / \sum_{i=1}^n \sum_{j=1}^n L_{ij}}$$

Because of the classification of information service industry in our country, the statistical system is not perfect, it is difficult to obtain the statistical data of each city information service industry. Here, only according to statistical caliber of information service industry in Beijing city (including computer and information services) at the same time, considering the availability of data, increased by 2014 in China and Beijing, Shanghai, Guangzhou, Shenzhen and other information service industry development level is higher the city's "computer and information service industry value" as the basic data. Calculate the location quotient of each city information service industry. This article will use the service industry added value and GDP as the comparison object of information service industry, thus more scientific and objectively reflect the status of Beijing in the domestic main city information service industry competitiveness. Results are shown in Table 3.

Table 3. The location quotient of information service industry

index City	Added value of computer and information services	Service industry added value		Gross Regional Product	
		Third industrial added value	Location quotient 1	Gross Regional Product	Location quotient 2
Beijing	2434.10	16627.0	3.3	21330.8	5.3
Shanghai	1563.09	15275.7	2.3	23567.70	3.1
Guangzhou	499.10	10897.2	1.0	16706.9	1.4
Shenzhen	648.4	8198.1	1.7	14500.2	2.1
Tianjin	314.1	8604.1	0.8	15727.0	0.9
country	13549.4				

From Table 3 the calculation results, the added value of the service industry and to GDP as a comparison calculation for Beijing's information service industry location quotient were 3.3, 5.3, two higher than the national average, and far more than Shanghai, Guangzhou, Shenzhen city. In addition, from the overall size of the industry, the rapid growth of information service industry in Beijing city in 2014 12.4%, the total revenue reached 208 billion yuan, ahead of Shanghai and other domestic provinces and cities (Shanghai city in 2014 was 140 billion yuan, Shenzhen City, about 65 billion yuan), the overall competitiveness of the industry ranked first in the country. Relative to the main Shanghai, Guangzhou and other domestic city, has obvious competitive advantage the Beijing information service industry development scale, enterprise comprehensive strength, innovation level and other aspects, related products and services showed strong competitiveness in the market.

3. Influencing Factors of the Competitiveness of Information Service Industry

The information service industry as a high value-added, high content of knowledge of the industry, its development depends on many different factors influence a region's service exports can reflect the service industry competitiveness of the region, including the labor cost competitiveness, capital cost competitiveness, the degree of market concentration, enterprise maturity and industry development situation etc.. Through the analysis of Trade Gravity Model and theory to find the factors affecting the competitiveness of information service industry in Beijing mainly concentrated in the national social and economic development level, income level, education level, the level of Taxation, fixed assets investment, population structure, city level, industry related policies, etc.

3.1. Positive factors affecting the competitiveness of information service industry

- **Economic development level:** The economic level is an important factor affecting the competitiveness of information service industry in Beijing, the per capita GDP as a measure of a city or region is the most commonly used indicators of economic development, to the economy of a region or a city reflects the production status. From the second chapter of Beijing city GDP data can be seen, along with the economic level of Beijing city continues to improve, the demand changed, will be on the industrial upgrading, restructuring and transformation of economic growth mode put forward higher requirements, expand the demand of information service

industry in Beijing City, to promote the adjustment and optimization of policy the information service industry, will provide a good economic environment and institutional environment for the enterprise information services, so as to promote the good development of information service industry, enhance the competitiveness of information service industry in Beijing.

- **Income level:** The Beijing information service industry enterprise income in recent years maintained a growth trend, the average per capita income also will continue to improve, provide a good foundation for the development of information service industry, by raising the level of income, attract talent and technology more investment to the industry, enhance the competitiveness of information service industry in Beijing.
- **Infrastructure construction:** The infrastructure of information service industry is the infrastructure resources which are related to the development of information service industry, mainly including electronic equipment, computer, mobile communication equipment, Internet technology equipment and so on. Information service industry infrastructure resources for a city or region of the information service industry supply capacity development play a vital role. Since 12th Five-Year, Beijing is committed to the construction of the capital city, and constantly improves the information infrastructure. If the lack of relevant infrastructure resources, will fundamentally inhibit the supply of information services capabilities, and thus hinder the development of information services. Therefore, infrastructure is an important factor that affects the competitiveness of Beijing's information service industry, and has a positive impact on competitiveness.
- **Investment scale:** Because of the information service industry is a capital intensive and high risk industry, its development cannot do without large capital investment to improve infrastructure, technological innovation, marketing and talent introduction, the scale of investment will directly affect the supply capacity of information service industry. In the current economic development has entered a new norm under the background of industrial restructuring, Beijing information service industry and other emerging industries investment growth accelerated, promote industrial transformation and upgrading of traditional industries, the investment has shown a downward trend. The continuous expansion of investment scale can effectively promote the development of information service industry, and enhance the competitiveness of information service industry.

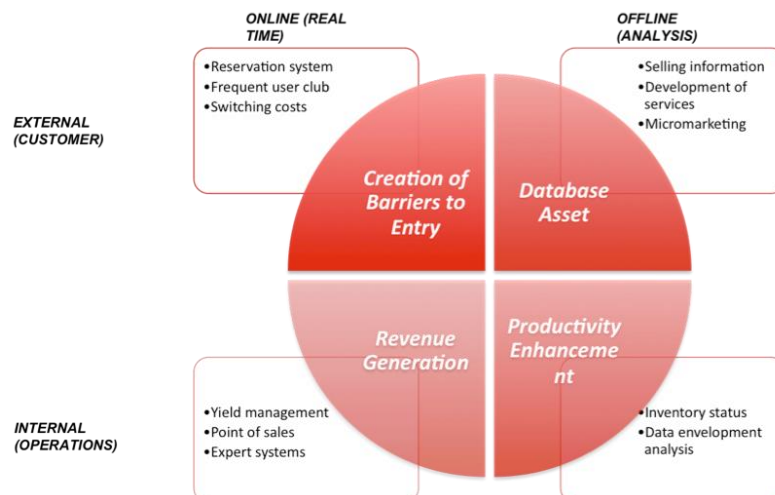


Figure 5. Information service industry competitiveness

3.2. The negative factors affecting the information service industry

- **Geographical distance:** The distance difference can reflect the size of transaction cost and preference to a certain extent, reliable inter city transportation, good international transport links and high quality local transportation, is particularly important for modern high technology industry. As a new high-tech industry, the traffic condition has become an important location factor. The marginal cost of information service products across geographic space transmission is almost zero, which means that the information service enterprise agglomeration is no longer affected by distance factors and traffic conditions. Because the information service industry of Beijing still has the problem of unbalanced regional development, geographical distance has a negative effect on the promotion of competitiveness.
- **Tax level:** Tax will affect the income and development costs of information services. In today's society, the rapid development of economic globalization, information service industry has become a new growth point or is a national and regional economy, plays an increasingly important role in promoting the optimization and upgrading, enhance international competitiveness of national or regional industrial structure. Based on this, more and more countries incline to the information service industry in the policy and management system, the city of Beijing municipal government in recent years also try to introduced the relevant industrial policies, the aim is to develop the information service industry to reduce the cost. The government should play a proper role in the introduction of relevant industrial tax policy, to create more economic benefits for the community. Therefore, the preferential tax policy can promote the development of the information service industry, so as to strengthen the competitiveness of the information service industry.

4. The Empirical Analysis

4.1. The selection of variables

Because there are too many influencing factors, we only consider those factors which have direct or indirect effects on the dependent variables, and therefore, we need to omit some of the factors which have indirect effect or small effect. The influence in the information service industry competitiveness factors empirical analysis, according to the index principles and the availability of data, combined with the actual situation of Beijing City, analyzes the corresponding factors of the corresponding index. Select Beijing city from 2004 to 2014 for a total of 11 sets of data for the sample period, the data from the Beijing Municipal Bureau of statistics and China service trade guide network.

Table 4. Information service industry measurement

Serial	influence factor	Measurement index	unit
1	Economic development level	Logarithmic per capita GDP	Billion yuan
2	Income level	per capita income	Million yuan
3	Infrastructure construction	Number of Internet users	Million yuan
4	Investment scale	R&D expenditure	Million yuan
5	Geographical distance	Geographical distance from Beijing	kilometre
6	Tax level	Revenue	Billion yuan

The per capita GDP, per capita income, fiscal revenue, R&D expenditure, the number of Internet users, the geographical distance with the independent variables X1, X2, X3, X4, X5, X6. The use of a simple form of bilateral trade flow measurement model, with the GDP of the total economic output to replace the mass in the gravity model, with the distance between the state to replace the distance between the mass center of mass. After the modeling, it is concluded that a country's trade flows to the other countries, mainly depends on the country's economic scale and geographical distance between the two countries. The most basic form of trade gravity model is:

$$X_{AB} = \lambda \beta_1 (GDP_A GDP_B) / \beta_2 DIST_{AB}$$

Where XAB represents the bilateral trade flows between the state A and the state GDPA, B and GDPB respectively represent the economies of the two countries, DISTAB is used to measure the distance between the two countries, the proportion of the constant. The model shows that the scale of bilateral trade flows between the two countries is directly proportional to their respective economic output, and is inversely proportional to the distance between them. In order to get the gravity estimation equation, the formula is transformed into a logarithmic linear form, and a random error term is added:

$$\ell X_{AB} = \lambda + \beta_1 \ell(GDP_A GDP_B) + \beta_2 \ell DIST_{AB} + \varepsilon$$

Bergstrand (1989) selection of the utility function in consumer income constraints and the existence of profit maximization under different product supply function, the H-O model and the assumption of monopolistic competition link according to the utility maximization under the condition of price and profit maximization (or cost minimization) quantity under the condition of constructing gravity model. Based on the research of several scholars, the formula of information service trade under the new trade theory can be established:

$$M_{AB} = \rho_0 * G_A^{\rho_1} * G_B^{\rho_2} * D_{AB}^{\rho_3} * T_{AB}^{\rho_4}$$

Based on the above analysis, combined with the new trade theory under the guidance of the logarithmic equation, the beginning of empirical analysis, that is, the:

$$\text{Ln}(Y) = a + b \ln X1 + c \ln X2 + d \ln X3 + e \ln X4 + f \ln X5 + g \ln X6 + \beta$$

Among them, the added value of Y on behalf of the information service industry, X1 on behalf of GDP per capita, X2 per capita income, X3 revenue, X4 on behalf of R&D expenditure, X5 represents the number of Internet users, X6 on behalf of the information service industry enterprise geographic distance.

4.2. The selection of variables

First of all, the use of Eviews5.0 software to explain the variable correlation test, found that the per capita GDP and per capita income has a clear autocorrelation, so to eliminate the explanatory variables per capita income. In order to avoid the pseudo regression equation, and then the rest of the variables for ADF test, the results see Table 5. From Table 5, we can know that the geographical distance T value is greater than the critical value of DF, indicating that the variable exists unit root, which is a non stationary sequence. The rest of the variables were tested by ADF, which showed that the model was established.

Table 5. ADF test

Serial	T statistic	5% critical value	10% critical value	P value
per capita GDP	-4.017811	-3.14492	-2.71375	0.0119
fiscal revenue	-5.763711	-3.2127	-2.74768	0.0014
R&D expenditure	-5.927133	-5.33835	-4.18763	0.0368
Internet users	-4.160932	-3.14492	-2.71375	0.0094
geographical distance	-2.670825	-3.25981	-2.77113	0.1152

After the unit root test, Eviews regression was carried out on the above variables, and the regression equation was obtained as follows:

$$\ln(Y) = -43.694 + 11.3844\ln X_1 + 0.54314\ln X_4 + 0.0297\ln X_5 - 0.11475\ln X_3$$

Wherein: Y represents information transmission, computer software, value added, X1 on behalf of GDP per capita, X2 per capita income (coefficient 0), X3 represents revenue, X4 represents R&D expenditure, X5 represents the number of Internet users, X6 represents the geographical distance (coefficient 0). The R value of the model is 0.9647, which shows that the model is fit for the sample. At the 5% significance level, F value is 3.48, the model $F = 61.5756 > 3.48$, indicating a significant regression equation, the per capita GDP, fiscal revenue, R&D expenditure and the number of Internet users and other variables combined does add value has a significant effect on the transmission of information, computer and software, so the model set the establishment.

4.3. Results analysis

Through the analysis of the standard model coefficient shows that the 4 indicators of information transmission, computer software, the added value of the most significant impact is the per capita GDP (11.3844), followed by R&D (0.5431) expenditure and revenue (-0.1148), the last is the number of Internet users (0.0297), far behind the front three indicators, the regression results show that the level of economic development of information service industry in Beijing city to increase the value of the most significant impact, followed by the scale of investment, and actively promote the role of information service industry in Beijing, there is a negative correlation between the tax and the Beijing information service industry, infrastructure construction also has a positive correlation with Beijing information service industry, but has no significant effect on it. So we can analyze the following conclusions:

(1) The improvement of economic level can promote the development of information service industry

Per capita GDP as a measure of the most commonly used economic development indicators of a region or city, can comprehensively reflect the status of a regional or urban production and economic operation. With the growth of GDP per capita, city economic level rising, the demand changed, will be on the industrial upgrading, restructuring and transformation of economic growth mode put forward higher requirements, expand the city or regional demand for information service industry, promote the adjustment and optimization of policy of information service industry, will to provide a good economic environment and institutional environment for the enterprise information services, so as to promote the good development of information service industry.

(2) The continuous expansion of investment scale can effectively promote the development of information service industry

Because of the information service industry is a capital intensive and high risk industry, its development cannot do without large capital investment to improve infrastructure, technological innovation, marketing and talent introduction, the scale of investment will directly affect the supply capacity of information service industry. In the regression model, R&D expenditure index coefficient is 0.5431, said in the same hypothesis variables, R&D expenditure increased by 100 million yuan, information transmission, computer software, the added value increased 54 million 310 thousand yuan; the index ranked second, illustrate the influence of the scale of investment in information service industry after the city economic development the development of the continuous expansion of the scale of investment can effectively promote the information service industry, which is consistent with the theoretical results and experience.

(3) Management system and government policy support are the external conditions that affect the development of information service industry.

Sound management system and effective policy support can encourage and protect the development of information service industry. In today's society, the rapid development of economic globalization, information service industry has become a new growth point or is a national and regional economy, plays an increasingly important role in promoting the optimization and upgrading, enhance international competitiveness of national or regional industrial structure. Based on this, more and more countries in policy and management system to the information service industry, so as to promote the development of information service industry, to create more economic benefits for society. For example, the information service industry and formulate relevant laws and regulations, the special management development planning; strengthening infrastructure construction; issued land and tax preferential policies, intellectual property protection policy, talent development policy; improve the market supervision system of information service industry; *etc.* According to the regression results, fiscal revenue index coefficient is -0.1148, said in the same assumption variables, fiscal revenue decreased by 100 million Yuan per year, information transmission, computer software, the added value will increase 11 million 480 thousand Yuan. Thus, there is a negative correlation between tax and information service industry, which shows that the tax will affect the income and development costs of information services. Therefore, the preferential tax policy can promote the development of the information service industry.

(4) Infrastructure promotes information service industry competitiveness

The infrastructure of information service industry is the infrastructure resources which are related to the development of information service industry, mainly including electronic equipment, computer, mobile communication equipment, Internet technology equipment and so on. Information service industry infrastructure resources for a city or region of the information service industry supply capacity development play a vital role. If the lack of relevant infrastructure resources, will fundamentally inhibit the supply of information services capabilities, and thus hinder the development of information services. Therefore, the infrastructure is an important factor affecting the competitiveness of the information service industry. But in the regression model, representing the infrastructure of international Internet users coefficient of only 0.0297, ranked 4 in a measure of the last one, said in the same hypothesis variables, the number of Internet users increased 10 thousand, information transmission, computer software, the added value increased by only 2 million Yuan, and its influence the intensity is far behind the other three indexes. Analysis of the reasons, partly because of a number of Internet users is only the infrastructure of information service industry, that is to say the infrastructure impact on the information service industry is not only the number of all covered by Internet users, on the other hand, the infrastructure of the industry have a certain lag, the effect is not immediately apparent.

5. Conclusions

In this paper, we choose 6 variables that affect the competitiveness of the information service industry in Beijing, namely, the level of economic development, the scale of investment, geographical distance, the construction of infrastructure, the level of income and the level of taxation. Through theoretical and empirical analysis, we can see that the 6 factors corresponding to the index: GDP per capita, R&D expenditure, geographical distance, the number of Internet users, financial income, per capita income, per capita GDP of Beijing information service industry competitiveness is the most significant, followed by the R&D expenditure, influence the number of Internet users and the geographical distance on the Beijing information service industry competitiveness is not obvious, have a negative impact on the revenue competitiveness of information service industry in Beijing. The information service industry competitiveness, steady growth depends not only on the level of regional economic development, but also depends on the information service industry continue to expand the scale of investment, but also to have and the information service industry to adapt to the development requirements of the industrial policies and effective supervision system and common function. Beijing city municipal government comprehensive use of financial investment, preferential policies and macro-control measures, give full play to the functions of the government, combined with the characteristics of various aspects of the industrial activities of the information service industry, improve the legal system; strengthening the construction of information infrastructure, especially in infrastructure area outside the capital circle; broaden the financing channels, to expand the scale of investment the information service industry, four combination; establish and perfect the supervision system, and create a favorable environment for industrial development, in order to effectively improve the competitiveness of information service industry in Beijing.

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