# An Empirical Study on the Impact of Service Industry Agglomeration on High Quality Economic Development in Beijing, Tianjin and Hebei

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**Abstract.** This paper uses the panel data of 13 cities in Beijing-Tianjin-Hebei region from 2012 to 2020 and uses TOPSIS to construct the economic quality development index in four aspects: scientific innovation, economic quality, green ecology and life security, followed by the calculation of the service industry aggregation index of each city using the locational entropy method. Finally, the regression is fitted by panel Tobit model, and the results show that the spatial distribution pattern of service industry aggregation in the region shows Beijing and Tianjin as the core, but the degree of service industry aggregation in Beijing and Tianjin as the core of aggregation gradually decreases in the long term, while the degree of aggregation in other prefecture-level cities gradually increases. More importantly, the service industry agglomeration in Beijing-Tianjin-Hebei region has a significant positive contribution to high-quality economic development in the long run.

**Keywords:** service industry aggregation, high quality economic development, Beijing-Tianjin-Hebei region, TOPSIS.

## 1. Background and Literature Review

Since the reform and opening-up and modernization, China has created numerous miracles under the leadership of the Communist Party of China (CPC), and China's economic level has grown by leaps and bounds. However, this outward-looking growth model is constrained by many conditions, such as rising labor costs, natural resource constraints, and declining investment efficiency. In fact, various economic indicators are telling us that China's economic growth rate is gradually declining and that the previous empirical approach to development may be difficult to practice in the future.

The Beijing-Tianjin-Hebei region, as the pioneer of China's economic development and the testing ground of various economic policies, has been highly valued by the country for its economic indicators. 2015, the Central Committee of the Communist Party of China put forward the Beijing-Tianjin-Hebei cooperative development strategy to achieve industrial aggregation, functional integration and innovation leadership in the Beijing-Tianjin-Hebei region, and to promote the spillover effect brought by the manufacturing and production service industries of megacities such as Beijing and Tianjin, which brings about a spillover effect for the whole country. This will serve as a leading model for industrial clustering and development in other parts of the country. In this background, Li Jian Ming used the service industry-related indexes in Hebei Province from 2006 to 2015 to empirically analyze the relationship between industrial agglomeration and residents' income growth under the coordinated development of Beijing-Tianjin-Hebei, and found that the economic density of service industry in Hebei Province has a negative effect on the local residents' income growth, while the degree of service industry agglomeration has a positive effect on the residents' income growth [1]. Zhou Min Sheng and Wang Shuai analyzed the impact of service industry agglomeration on economic growth in Beijing-Tianjin-Hebei region by using the data related to each sector of service industry in the city cluster from 2003 to 2014 for locational entropy index analysis and panel data model estimation, and concluded that the service industry in Beijing-Tianjin-Hebei region has Beijing and Shijiazhuang as the core differential agglomeration, and this differential agglomeration has a significant effect on economic growth in the short term The promotion effect is obvious in the short term, but not significant in the long term [2]. Using the spatial panel data of 38 cities in the Beijing-Tianjin-Hebei region urban agglomeration and the Yangtze River Delta urban

agglomeration from 2000-2014, Zheng Zhi Dan argued the deeper reasons for the imbalance of economic and financial development in the Beijing-Tianjin-Hebei region urban agglomeration from the perspective of financial agglomeration and economic convergence, and proposed an opinion for finding a suitable path of synergistic development for the region in the context of integration [3]. Through a review of past literature, Jiawei Chen and Xia Yang analyzed the relationship between knowledge spillover, industrial agglomeration, and regional economic growth, and showed that the negative economic effect of industrial agglomeration has the probability to hinder regional economic development [4]. Jun Jie Li and Xue Yan Wang selected dynamic panel data of 13 cities in the Beijing-Tianjin-Hebei region from 2006 to 2018 and conducted an empirical study on the effects of industrial agglomeration and high-quality economic development in the Beijing-Tianjin-Hebei region using the systematic generalized moment estimation (GMM) method, concluding that there are differences in the effects of agglomeration and congestion effects of different industries on high-quality economic development in the Beijing-Tianjin-Hebei region [5].

At present, a large proportion of domestic studies on the effect of industrial agglomeration on economic growth and national income, but there are few studies on economic quality development from the perspective of industrial agglomeration, and there is a lack of regional studies. This study focuses on Beijing-Tianjin-Hebei and investigates the effect of its service industry agglomeration on regional economic quality development to fill the gap in the research field. This paper takes Beijing-Tianjin-Hebei region as the research areas and selects the data of 2 municipalities and 11 prefecture-level cities in Beijing-Tianjin-Hebei region from 2012 to 2020 to construct indicators to further study the impact of service industry agglomeration on the high-quality economic development in the region.

## 2. Variable Selection and Research Methodology

In this paper, ten different data from Beijing and Tianjin, and eleven prefecture-level cities in Hebei Province, including Shijiazhuang, Tangshan, Qinhuangdao, Handan, Xing Tai, Baoding, Zhangjiakou, Chengde, Cang Zhou, Lang Fang, and Heng Shui from 2012 to 2020 (Table 1), were collected from the China Urban Statistical Yearbook and the Hebei Provincial Statistical Yearbook.

### 2.1 Explained variables

To measure the level of high-quality economic development in Beijing-Tianjin-Hebei region, drawing on the views of Ren Hai and Wu Yun Liang [6-7], this paper constructs the index of high-quality economic development level from four perspectives: scientific and technological innovation, economic quality, green ecology, and life security.

**Table 1.** Indicators of the level of quality economic development

| Tier 1 Indicators | Tier 2 Indicators | Unit | Indicator Properties |
|---|---|---|---|
| Scientific Innovation | Number of Invention Patents Granted | - | Positive |
| Economic Quality | Gross regional product (current year prices) | Billion | Positive |
| | Number of employees in urban units at the end of the period | - | Positive |
| | Share of secondary industry in GDP | % | Positive |
| | Share of tertiary sector in GDP | % | Positive |
| Green Ecology | Industrial wastewater discharge | million tons | Negative |
| | Greening coverage of built-up areas | % | Positive |
| Life Security | Number of beds in medical and health institutions | - | Positive |
| | Number of urban workers' basic pension insurance participants | - | Positive |
| | Number of Unemployment Insurance Participants | - | Positive |

In this paper, the entropy weighting method (TOPSIS) is used to objectively assign weights to each indicator using the entropy value method for panel data containing years, cities, and indicators, so as to derive a comprehensive score for each city to objectively measure the level of high-quality regional economic development as follows: $X_{\theta ij}$ is used to denote the value of the $\theta$ year, the $i$ city, and the $j$ indicator. Different indicators have different units and scales, so all indicators need to be standardized. For positive indicators, i.e., those whose values are larger, the better:

$$X'_{\theta ij} = \frac{X_{\theta ij} - X_{\min}}{X_{\max} - X_{\min}} \tag{1}$$

And for negative indicators, i.e. indicators with smaller values:

$$X'_{\theta ij} = \frac{X_{\max} - X_{\theta ij}}{X_{\max} - X_{\min}} \tag{2}$$

Where, $X_{max}$and $X_{min}$represent the maximum and minimum of the j indicator in the i city in all years, i.e., the maximum and minimum values of each indicator for all years are taken. Here, the maximum or minimum value of the current year cannot be taken, but the maximum and minimum values of all years should be taken. The standardization may take logarithms for values less than or equal to 0, which cannot be calculated, so a non-negative shift is generally used:

$$X'_{\theta ij} = X'_{\theta ij} + 0.01 \tag{3}$$

Then the weights are calculated:

$$Y_{\theta ij} = \frac{X'_{\theta ij}}{\sum_{\theta}\sum_{i} X'_{\theta ij}} \tag{4}$$

Recalculating the entropy value:

$$S_j = -k\sum_{\theta}\sum_{i}(Y_{\theta ij}\ln Y_{\theta ij}), k = \frac{1}{\ln(rn)} \tag{5}$$

where r is the number of years and n is the number of cities.

The next step will be to calculate the coefficient of variation, or redundancy, for each indicator:

$$E_j = 1 - S_j \tag{6}$$

The coefficient of variation is then used to calculate the weights of each indicator:

$$W_j = \frac{E_j}{\sum_{j} E_j} \tag{7}$$

The final step will be to calculate the composite score for each city under each year, i.e. the product of the indicator weights and the standardized indicator values:

$$H_{\theta j} = \sum_{j} W_j X'_{\theta ij} \tag{8}$$

### 2.2 Core explanatory variables

To further measure the degree of service industry aggregation in Beijing-Tianjin-Hebei region, this paper refers to the method of Ye Lin Wei [8] and uses the localization entropy method to calculate the degree of service industry aggregation ( $Se_{\theta i}$) in each city in Beijing-Tianjin-Hebei region in year θ:

$$Se_{\theta i} = \frac{E_{\theta ij} \Big/ \sum_{j} E_{\theta ij}}{\sum_{j} E_{\theta ij} \Big/ \sum_{i}\sum_{j} E_{\theta ij}} \tag{9}$$

Where $E_{ij}$ denotes the economic indicators of industry j in city i in year θ, such as output value, employment scale, main business income or industry value added, etc. In this paper, the number of

employees in the service industry in each city of Beijing, Tianjin and Hebei region is selected to represent the employment scale and substituted to calculate the locational entropy.

### 2.3 Control variables

For the selection of control variables, this paper considers four perspectives of government support, human capital, regional market development, and science and technology, and selects government expenditure (million yuan) GE, total household registration population (10,000 people) CRP, employment rate ER and science and technology expenditure growth rate STEGR, respectively, with data from the 2012-2020 China Urban Statistical Yearbook and China Statistical Yearbook.

After selecting all variables, because the regional economic quality development index, i.e., the explanatory variables, are all between 0 and 1, which are truncated discrete type of data and meet the conditions of the dependent variable of Tobit model that can handle truncated discrete data, the panel Tobit model is used and the model is constructed by referring to Qian Haiyan and Jiang Yu's method [9] as follows:

$$Y_{\theta j} = \begin{cases} H_{\theta i}, Y_{\theta j} > 0 \\ 0, Y_{\theta j} < 0 \end{cases} \qquad (10)$$
$$Y_{\theta j} = \alpha_0 + \beta Se_{\theta i} + \varepsilon_{\theta j}$$

Where β is the parameter to be estimated, $\varepsilon_{\theta j}$ is the random error term, and $\alpha_0$ is the constant term. $H_{\theta i}$ is the explanatory variable, i.e., the economic quality development score of each city, and $Se_{\theta i}$ is the core explanatory variable, i.e., the locational entropy of each city's service industry aggregation degree. If control variables are added, the model becomes.

$$Y_{\theta i} = \alpha_0 + \beta Se_{\theta i} + \beta_1 GE + \beta_2 CRP + \beta_3 ER + \beta_4 STEGR + \varepsilon_{\theta j} \qquad (11)$$

## 3. Results and Robustness Tests

### 3.1 Analysis of the results

After calculating the Beijing-Tianjin-Hebei economic quality development index and the service industry aggregation index, the regression results of its service industry aggregation index and control variables on economic quality development are shown in Table 2.

**Table 2.** Tobit model regression results

| EHQD | Tobit | |
|---|---|---|
| | (1) | (2) |
| Se | 0.0774*** | 0.0960*** |
| | (0.0119) | (0.0171) |
| GE | | -0.0013*** |
| | | (0.0004) |
| CRP | | 0.0115*** |
| | | (0.0017) |
| ER | | 0.0160*** |
| | | (0.0006) |
| STEGR | | -0.0093*** |
| | | (0.0018) |
| sigma_u | 0.2462 | 0.0146*** |
| | (0.0483) | (0.0039) |
| sigma_e | 0.0245 | 0.0230*** |
| | (0.0017) | (0.0016) |
| LR | | 16.3*** |

Where model (1) indicates that no control variables are included, and model (2) indicates that control variables are included. Their regression results illustrate that the degree of service industry

agglomeration is positively correlated with high-quality economic development in both cases, which is significant at the 1% level, indicating that service industry agglomeration in Beijing-Tianjin-Hebei region contributes to the high-quality economic development of the region. Combined with the viewpoint of Jing Jing Wang [10], the analysis is as follows: first, service industry specialization aggregation will accumulate high quality and high level labor talents, facilitate related technology learning and exchange, and jointly improve production technology as well as service quality; second, thanks to service industry aggregation, related costs such as talent search costs and transportation costs will be significantly reduced; third, information asymmetry between service industry enterprises will be reduced, effectively approaching Fourth, service industry agglomeration can promote competition in service industry, further improve the overall production and service quality, and promote regional economic development.

According to macroeconomics, the increase in government spending and government purchases will bring about a crowding-out effect, which will in turn inhibit private investment and restrict high-quality economic development, so its regression coefficient is negative. As for human capital and regional market development - household population and employment rate - their positive correlation with high-quality economic development is obvious; more consumers and labor force will certainly create more wealth. The reason for the negative regression coefficient of the growth rate of science and technology expenditures is that science and technology expenditures will bring about an increase in productivity level in the long run, but which will not bring about an effective effect in the short run and will even increase the burden on the government and affect other aspects of expenditures, thus hindering economic development.

### 3.2 Robustness test

Since the values of the explanatory and explanatory variables and indicators are extremely high in Beijing, which is very different from the second ranked city, Tianjin, and even more different from other prefecture-level cities, the regression results may be influenced by their polarization. In order to avoid the phenomenon of "pseudo-regression", a robustness test is needed to ensure the stability of the results. This is done as follows: all indicators for Beijing are excluded from the construction of the explanatory and explained variables, i.e., only Tianjin and 11 cities in Hebei province are studied, and the above steps are repeated. The results are shown in Table 3 below.

**Table 3.** robustness tests

| EHQD | Tobit | |
|---|---|---|
| | (3) | (4) |
| Se | 0.0173*** | 0.1438*** |
| | (0.0251) | (0.0371) |
| GE | | 0.0056*** |
| | | (0.0019) |
| CRP | | 0.0222*** |
| | | (0.0034) |
| ER | | 0.0215*** |
| | | (0.0021) |
| STEGR | | -0.0153*** |
| | | (0.0033) |
| sigma_u | 0.2070*** | 0.0266*** |
| | (0.0424) | (0.0135) |
| sigma_e | 0.0313*** | 0.0394*** |
| | (0.0026) | (0.0033) |
| LR | | 8.63*** |

In the results of the robustness test, the coefficients of the core explanatory variables and control variables did not change much in terms of positivity, negativity and significance, and the LR test passed the 1% significance test, indicating that the results of this paper are robust.

## 4. Conclusions and recommendations

In this paper, through the descriptive analysis of the location entropy index of service industry in Beijing, Tianjin and Hebei region, the degree of high-quality economic development in Beijing, Tianjin and Hebei region is calculated by the entropy method as an objective weighting method to exclude subjective influence. At the same time, the degree of regional service industry agglomeration is carved out by the locational entropy method, and combined with the panel Tobit model that can deal with the restricted dependent variables, the ideal positive results are obtained and the following conclusions are analyzed: firstly, the service industry development in Beijing-Tianjin-Hebei region presents an agglomeration trend with Beijing as the main core and Tianjin as the secondary core, but the degree of agglomeration and development in its peripheral cities is weak, and there is obviously an industrial imbalance and un There is an obvious industrial imbalance and uncoordinated development. Secondly, the service industry agglomeration in Beijing-Tianjin-Hebei region has a significant positive driving effect on the regional economic high-quality development, and its driving effect is more significant under the effect of the control variables related to the economic high-quality development. As for the control variables, human capital and regional market development can contribute to the development of service industry agglomeration, while government expenditure and science and technology expenditure can bring about inhibitory effects and thus hinder the development. It is worth noting that due to various factors, Beijing and Tianjin, the core cities of the agglomeration, have experienced a decline in the degree of agglomeration over time, which may be detrimental to economic development in the future and requires the attention of relevant governments and institutions.

In the light of the above results and reviews, this paper gives the following suggestions: to continue to contribute to the coordinated development of Beijing-Tianjin-Hebei, to further emphasize the regional consistency and coordination of service industry agglomeration, to pay attention to the adjustment and optimization of the internal structure of service industry, and to improve the overall competitiveness level; to pay attention to the problem of high industrial isomorphism in the development process and to avoid the sprouting of excessive competition; to pay attention to the employment situation and to actively explore employment and related talent With the advantage of dense distribution of colleges and universities in Beijing, Tianjin and Hebei, we can make efforts to cultivate more high-level and high-quality labor force and high-end elites, and give a series of incentives to retain talents and improve the overall labor force quality level; the coordinated development of Beijing, Tianjin and Hebei region needs a relatively open market environment and strong policy support, and under the guidance of relevant policies, promote the "simplification and decentralization Under the guidance of relevant policies, we should promote the process of "decentralization" and give full play to the market mechanism in order to realize the efficient operation of the market. It is also necessary to pay attention to the development of transportation, manufacturing and other industries to emulate the efficient gathering of service industries, and then to promote the integrated development of Beijing-Tianjin-Hebei in a comprehensive manner.

In the future, to promote the development of the service industry in each region of the country should always bear in mind the "Guidance Opinions of the General Administration of Market Supervision of the National Development and Reform Commission on the High-Quality Development of the Service Industry in the New Era", deepen the reform of the supply-side structure of the service industry, strongly support the innovation and upgrading of the traditional service industry, actively cultivate new industries, new industries and new modes of service industry, accelerate the development of modern service industry, and strive to build a new system of high-quality and efficient, layout The new system of service industry with high quality and high efficiency, optimized layout and strong competitiveness will continuously meet the needs of industrial transformation and upgrading and people's needs for a better life, and provide important support for achieving high-quality economic development.

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