Evaluation of Regional Industry Transfer Undertaking Ability Based on Sustainable Development

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This study finds six factors which have a great influence on regional industry transfer undertaking ability: level of technical research and development, cost conditions, market potential, industrial supporting capacity, level of regional development, and environmental carrying capacity. The study collects the relevant data from 2000 to 2014 in the Jing-jin-ji Region and calculates the factor and comprehensive score of its industry transfer undertaking ability. The results show that the practice of evaluating these six factors can provide suggestions for the promotion of regional industry transfer.

Keywords: Industry Transfer, Undertaking Ability, Sustainable Development.

Introduction

In recent years, the development of regional economies has become a hot research topic, especially uneven regional development. It could cause problems including an unreasonable allocation of resources and environmental pollution. Industry transfer from the perspective of sustainable development is an important approach to accelerate the transformation of regional economic development, and to optimize and upgrade regional industrial structure. This study intends to examine the influencing factors of the regional industry transfer undertaking from the perspective of sustainable development, and to evaluate it by using actual data and methods in order to determine the direction and path of industry transfer.

Overview of industry transfer

William A L found that developed countries transferred labor-intensive industry to developing countries because of rising labor costs¹. McKeon H et al. proposed to accept the transfer of multinational companies can accelerate the upgrading of industrial structure². Liu et al. analyzed the mechanism of interregional transfer and put forward the four types of industry transfer (i.e., raw material point, cost-driven, investment-driven, and concentration-dependent)³. Xie et al. proposed that if the speed of industry transfer and factory resource migration does not match, this would lead to the loss of economic efficiency⁴. Sun et al. built a new conceptual model for high-tech industry transfer and summarized its features⁵. Qin et al. put forward the concept of two categories of diffusion industry transfer and agglomeration industry transfer constructed the theory and method of industry transfer measurement⁶. Liu et al. analyzed the gradient trap of industry transfer, discussed the reason that it was difficult to upgrade industry for region of undertaking industry transfer, and proposed to make innovations to the mode of undertaking industry transfer⁷. Zhang G W used three indicators which is HHI index, location quotient, the absolute share of industry, observed the annual changes in order to measure industry transfer in China⁸. There has been much research on the mode and effect of industry transfer, but the research on the realization of industry transfer is sparse.

The factors of industry transfer undertaking ability

Combined with research on related theories of industry transfer, according to the suitable development principle, this study finds six factors
which have a great influence on regional industry transfer undertaking ability: 1) Technical research and development. R&D levels mainly display regional science and technology competitiveness. This factor is represented by R&D personnel and R&D expenditures. 2) Cost condition. This factor includes labor, land, and production costs and will directly affect the economic efficiency. High cost is not conducive to industry transfer. 3) Market potential. This factor includes product sales and the purchasing power of residents, economic benefits, and the level of marketization. If the market potential is greater, the region can attract more industry transfer. 4) Industrial supporting capacity. This factor includes the basic industry conditions and the facilities supporting industry development. 5) Regional development level. This factor includes the two aspects of economy and society. Industry tends to transfer to regions with high development levels. 6) Environmental carrying capacity. This factor includes the elements of natural resources, energy production levels, and environmental pollution and treatment. A region with serious pollution and/or a shortage of resources is not suitable for industry transfer.

Empirical analysis

Sample and indicator selection

In recent years, China has been faced with the problem of economic growth mode transition. Due to uneven regional development, some areas have experienced serious problems with population, resources, and environment. The Jing-jin-ji Region is composed of the Tianjin, Beijing, and Hebei provinces and is an important political and cultural center of China, as well as an important economic core area in the North. It is facing serious problems in the development of polarization. Seeking rapid economic development blindly and entering into an extensive mode of economic growth has created a serious burden on regional resources and the environment. Only by implementing industry transfer as soon as possible can promote the coordinated development of the Jing-jin-ji Region. Therefore, this study focused on the industry transfer undertaking ability of Jing-jin-ji Region. According to the factors of industry transfer undertaking ability, we selected 18 representative indicators to measure the industry transfer undertaking ability of the Jing-jin-ji Region. These are: 1) R&D staff full-time equivalent; 2) R&D funding internal expenditures; 3) urban non-private–sector employee average wage; 4) commercial housing sales prices; 5) purchase price index of raw materials, fuels, and power; 6) the sale ratio of industrial products; 7) resident consumption level; 8) ratio of profits to total industrial costs; 9) ratio of dependence on foreign trade; 10) number of industrial enterprises above designated size; 11) length of transportation routes; 12) GDP annual growth ratio; 13) per capita GDP; 14) per capita education years; 15) per capita water resources; 16) per capita energy production; 17) industrial pollution control investment; and 18) sulfur dioxide emissions/area GDP.

Method selection and data resource

This study collected the relevant data from the statistical data of Beijing, Tianjin, and Hebei for the years 2000 to 2014. Then the authors used factor analysis to measure the industry transfer undertaking ability of the Jing-jin-ji Region. Factor analysis is an objective method to determine index weight. It takes into account the effect of correlation between the indicators. When dealing with large amounts of data with multiple indicators, factor analysis can reduce the dimension of the original indicators, making the resulting factors independent. Factor analysis can simplify the original variables and eliminate the correlation between indicators, using a small number of integrated factors to reflect the amount of information contained in all original indicators. The mathematical representation of the factor analysis method is \( X = AF + B \), which means that:

\[
\begin{align*}
    x_1 &= \alpha_{11} f_1 + \alpha_{12} f_2 + \alpha_{13} f_3 + \ldots + \alpha_{1k} f_k + \beta_1 \\
    x_2 &= \alpha_{21} f_1 + \alpha_{22} f_2 + \alpha_{23} f_3 + \ldots + \alpha_{2k} f_k + \beta_2 \\
    x_3 &= \alpha_{31} f_1 + \alpha_{32} f_2 + \alpha_{33} f_3 + \ldots + \alpha_{3k} f_k + \beta_3 \\
    &\vdots \\
    x_p &= \alpha_{p1} f_1 + \alpha_{p2} f_2 + \alpha_{p3} f_3 + \ldots + \alpha_{pk} f_k + \beta_p
\end{align*}
\]

In the model, the vector \( X (x_1, x_2, x_3, \ldots, x_p) \) is an observable random vector, which is the original observation variable. \( F (f_1, f_2, f_3, \ldots, f_k) \) is the common factor of \( X \), which is the common occurrence of the expression of various original observation variables and is an independent non-observable theoretical variable. \( A (a_{ij}) \) is the coefficient of common factor \( F \), known as the factor load matrix. \( a_{ij} (i=1,2,\ldots,p; j=1,2,\ldots,k) \) are the factor load coefficients.
which is called the factor load, is the i-th variable in the weight of the common factor on J and indicates the dependence of $x_i$ on $f_j$. $B (\beta_1, \beta_2, \beta_3, \ldots , \beta_p)$ is a special factor of $X$, which cannot be included in the former $K$ common factors.

Data processing

There are three steps to complete before factor analysis. They are: 1) Index Positive Processing. Factor analysis is mainly for the absolute amount of data analysis, which requires the evaluation to be positive. This study takes the reciprocal approach to turn negative indexes into positive indexes. 2) Standardized Treatment. All the data should be standardized in order to unify the dimension of the data. 3) Data Examination. The data needs to pass the KMO test and Bartlett's spherical degree test. The value of KMO should be between 0 and 1; the closer to 1, the more suitable for factor molecules. The Bartlett's spherical degree test is to verify whether the data is the correlation coefficient matrix and the null hypothesis $H_0$ is the correlation coefficient matrix as the unit matrix. Based on the analysis of the sample data, we calculate that the KMO value is 0.711 and the corresponding $P$ value is 0. Therefore, the null hypothesis is rejected and the sample data is suitable for factor analysis. After calculating the correlation coefficient matrix, the maximum variance method is used to extract four common factors. The initial eigenvalue of the four common factors is greater than 1, and contains 85.118% of the original data. These four common factor variables can represent the main factors of the Jing-jin-ji Region industry transfer undertaking ability. The factor-loading matrix can be obtained by using the maximum variance orthogonal rotation method to rotate the common factor, thus we can find the influence coefficient of each indicator on the common factor. By setting the indicator as $x_i$, when the absolute value of the coefficient is greater than 0.8, it is considered that the index has a great influence on the common factors. $x_1$, $x_2$, $x_3$, $x_4$, $x_7$, $x_{13}$, $x_{14}$, $x_{18}$ have larger coefficients of the first common factor; $x_{10}$, $x_{11}$ have larger coefficients of the second common factor; $x_{16}$ has a larger coefficient of the third common factor; $x_5$, $x_6$ have larger coefficients of the fourth common factor. We then can calculate the score of each common factor by the factor score coefficient matrix (shown in Figure 1). Finally, according to the variance contribution rate of each common factor (38.675%, 20.031%, 14.217%, and 12.195%, respectively), we can calculate the weighted score, and get the comprehensive score of the Jing-jin-ji Region industry transfer undertaking ability (shown in Table 1).

Fig.1—Score of four common factors in the Jing-jin-ji Region from 2000 to 2014
Acknowledgments

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Conclusions and Policy Recommendations

Based on the above analysis, we can draw the following conclusions. Firstly, from the perspective of the whole region, the industry transfer undertaking ability of Beijing, Tianjin, and Hebei have all increased on a year-by-year trend. Our analysis shows that the comprehensive strength of Beijing, Tianjin, and Hebei continues to improve as they all have a good industrial capacity and industrial base. Secondly, from the perspective of the individual provinces, in previous years, the industry transfer undertaking ability of Beijing has been higher than that of Tianjin and Hebei, but in the last two years, the industry transfer undertaking ability of Hebei has increased significantly, making it higher than Beijing and Tianjin. Thirdly, from the perspective of the common factor, Beijing has good technology research and development capabilities and a good regional development foundation; Hebei has good market potential, and has industry-supporting capacity and a cost advantage; and Tianjin has a better energy production capacity. In conclusion, this study puts forward the following suggestions to promote the industry transfer of the Jing-jin-ji Region: firstly, Beijing and Tianjin can transfer part of their high-cost and labor-intensive industries to Hebei; secondly, Hebei should increase investments in R&D and improve R&D capability; thirdly, while seeking regional economic development, Hebei should pay attention to resource conservation and environmental protection.

References


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