An Empirical Study on the Factors Affecting the Efficiency of China's Enterprise Innovation Resource Allocation under the Supply Side Reform

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Abstract. In the long-term future of China, the healthy and orderly development of economic science and technology must find new kinetic energy, and guarantee its stability and long-term stability. One of the new dynamic mechanisms for benign operation is the structural reform and innovation on the supply side. Innovation is not only the innovation of technology, but also the allocation of resources and institutional innovation. Aiming at the status quo of China's enterprise innovation resource allocation under the supply-side reform, after conducting the basic research on the corresponding concept connotation, the DEA-Tobit analysis two-step method is used to innovate the industrial enterprises above designated size in 30 provinces and cities except Tibet in 2016. The resource allocation efficiency is quantitatively measured, and then the Tobit nonlinear regression analysis is carried out according to the efficiency value. The results show that increasing the investment in scientific and technological innovation will increase the efficiency of enterprise innovation resource allocation, and the degree of nationalization will lead to the efficiency of enterprise innovation resource allocation. Negative impact, the degree of education and openness of the region have no significant impact on the efficiency of enterprise innovation resource allocation.

Introduction

There is a big gap in the level of economic development of China's enterprises, and there is also a big difference in the ability of innovation among enterprises. This not only reflects the necessity of constructing a scientific and rational supply-side innovation system under the supply-side reform. It reflects the important influence of rationally optimizing the allocation of innovative resources on the implementation of China's current innovation-driven strategy and the deepening of supply-side reform. Therefore, this paper uses DEA-Tobit two-step method to empirically analyze the efficiency of enterprise innovation resource allocation and its influencing factors in 30 provinces and cities in China in 2016, and provide support for relevant departments to formulate scientific and rational innovation resource allocation decisions.

DEA-Tobit Two-Step Method

The specific steps of the DEA-Tobit method in this paper.

The first step is to analyze the DEA efficiency of enterprise innovation resource allocation in 30 provinces and cities in China. The efficiency index system was constructed, and the data of the input-output indicators were analyzed using the DEAP2.1 software to obtain an efficiency measure.

Second step is perform a Tobit regression analysis. The index system of influencing factors of enterprise innovation resource allocation efficiency is constructed. The efficiency measure value obtained in the previous step is taken as the dependent variable and the influencing factor is used as
the independent variable. The Totta regression analysis is performed by stata software, and the corresponding result is obtained. The regression analysis is performed by Tobit model. The regression coefficient obtained by the result can analyze the influence of each influencing factor on the decision-making unit. If there is a positive correlation, it indicates that each influencing factor is conducive to improving efficiency.

Influencing Factors of China's Enterprise Innovation Resource Allocation Efficiency Index Design

Enterprise Innovation Resource Allocation Efficiency Index Design

Innovative resource elements mainly include innovative human resources, innovative material resources, innovative financial resources and innovative technology resources. Among them, innovative human resources and innovative financial resources are the core and indispensable prerequisites for enterprise innovation resource allocation. Therefore, in the construction of enterprise innovation resource allocation efficiency index system, by referring to the existing research results, comprehensive consideration of the scientific, independent, representative, and availability of indicators, combined with the requirements of the DEA method for data, and strive to be more objective Responsive enterprise innovation resource allocation capabilities.

In view of DEA's comprehensive analysis of input-output data, the enterprise's innovative resource allocation system is composed of two systems: innovation resource input and innovation resource output. This paper mainly invests in innovative resources and innovation resources from different regions in the same period. Developed in two ways. The input of enterprise innovation resources mainly includes innovative human resources and innovative financial resources. The output of enterprise innovation resources mainly includes direct input and indirect output. Through the reading of existing literature and the search of data, the input indicators include the full-time equivalent of enterprise R&D personnel, the development expenditure of new enterprise products, and the R&D expenditure of enterprises; the output indicators include the number of patent applications, the number of valid invention patents, Technical market turnover, new product sales revenue.

Design of Influencing Factors of Enterprise Innovation Resource Allocation Efficiency

Enterprise innovation resource allocation is a nonlinear dynamic trend. The formation of this trend is the result of the interaction of various internal and external factors. Combining with the existing research on the efficiency of enterprise innovation resource allocation, this paper analyzes its influencing factors from many aspects. Based on the DEA method to measure its efficiency value, the Tobit regression model is used to trace the efficiency and difference of the innovation resource allocation. the reason. The measurement factors of enterprise innovation resource allocation include internal factors, government and external factors, including enterprise R&D capital investment intensity, enterprise human capital quality, enterprise growth ability, enterprise scale, enterprise technology innovation capability, enterprise technology innovation investment level, patent application. Number; economic level, regional R&D expenditure intensity, regional education level, regional industrial structure, nationalization level, government science and technology investment, level of production, study and research, and degree of openness. Specifically, it includes the internal expenditure of R&D expenditure of enterprises in each province, the sales revenue of new products, the proportion of the number of employees, the growth rate of the main business income, the sales revenue of new products, the turnover of technology market in different regions, and the technology of enterprises. The proportion of renovation expenditures to the sales revenue of new products, the number of patent applications (pieces); the regional GDP, the intensity of R&D expenditure, the proportion of financial education funds to the regional GDP, the proportion of the tertiary industry to the regional GDP, and the regions The proportion of industrial sales value of state-owned holding enterprises to the sales value of enterprises of the whole scale, the total amount of financial and scientific funds allocated by the local
government, the total internal expenditure of scientific research funds, the ratio of the total expenditure of domestic research institutions and universities to the external expenditure of R&D funds, and the total import and export volume. The ratio of GDP.

Data Sources

This paper selects the data of enterprise innovation resources in 30 provinces and cities in 2016 for analysis. The data of enterprise innovation resource allocation efficiency index system comes from China Statistical Yearbook 2017. The data of the index system of enterprise innovation resource allocation efficiency is derived from China Statistical Yearbook 2017, China Science and Technology Statistical Yearbook 2017, China Industrial Statistical Yearbook 2016.

Empirical Analysis

Analysis of the Efficiency Value of Enterprise Innovation Resource Allocation Based on DEA

Through the DEAP2.1 software, the efficiency analysis of the input and output data of enterprise innovation resources in 30 provinces and cities in China can be obtained. The average comprehensive efficiency of enterprise innovation resources in 30 provinces and cities nationwide is 0.823, and the average pure technical efficiency is 0.869. The efficiency is 0.949, which indicates that there is still much room for improvement in the allocation of innovative resources in China's enterprises. Among them, the efficiency of enterprise innovation resource allocation in 8 provinces and municipalities reached 1 and was effective for DEA, which accounted for 26.7% of all provinces and cities in Beijing, Jilin, Zhejiang, Anhui, Hunan, Guangxi, Chongqing and Qinghai. It shows that the efficiency of enterprise innovation resource allocation in these provinces and cities is considerable, most of them belong to the developed areas in the east. They have rich industrial policies, superior geographical location and relatively developed economy, which makes the innovation resources input and output efficiency of these provinces and cities more efficient. The other central and western regions are not very developed in general, and the relative industrial policies are not preferential, but also reached 1, indicating that the regional economic development is not a necessary condition for the effective allocation of innovative resources in the region. The efficiency of enterprise innovation resource allocation in 16 provinces and cities is in the stage of 0.7-1, accounting for 53.33% of all provinces and cities, indicating that the capacity of enterprises in these provinces and cities to improve their resources needs to be improved, and the remuneration of scale in most areas is increasing. The development potential is great and the development prospects are good. Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Shandong, Guangdong, Hubei, and Henan are in a state of diminishing returns to scale, indicating that despite the abundant resources of Jiangsu and Shandong, the efficiency of innovation resource allocation has not reached the effective state of DEA. The remaining areas are all below 0.7, including Inner Mongolia, Shandong, Hainan, Yunnan, Gansu and Shaanxi. The vast majority are in the western region. These regions are in the state of scale remuneration and have good development potential. It is necessary for the government and enterprises to cooperate to transform the way of enterprise innovation resource allocation and change the proportion of enterprise innovation resources to enhance the efficiency of enterprise innovation resource allocation. In general, the efficiency of enterprise innovation resource allocation in various provinces and cities in China needs to be improved. Most of them are in the state of increasing returns to scale, and the development momentum is good. The central and western regions are quite different from the eastern regions. It is extremely urgent to seek new ways to allocate innovative resources.

DEA-Based Analysis of Enterprise Innovation Resource Allocation Efficiency Slack Variables

From the calculation of the slack variables of the input and output indicators of each DMU in 2016, we can see the redundancy and deficiency of the input and output of innovative resources of enterprises in various provinces and cities in 2016. Among the innovation inputs, R&D personnel in
14 provinces and cities have redundancy in full-time equivalents, and the redundancy rate is 46.67%, indicating that the R&D personnel of various provinces and cities in China have invested too much. In addition to Hebei and Fujian, the 14 provinces and cities are in the east. The rest of the area is in the central and western regions. The more serious areas include Henan (47549.504 person-years) and Fujian (16526.738 person-years); the internal expenditures of R&D funds in 18 provinces and municipalities are redundant, with a redundancy rate of 60.00%. Redundancy is more serious. Redundancy of R&D institutions includes redundancy in Fujian, Jiangxi, Shandong, Guizhou, Yunnan, Xinjiang, Gansu, Ningxia and Shaanxi. New product funding development expenditures are currently in good condition. It can be seen from the above data that in 2016, the R&D personnel of national enterprises are less invested than R&D funds, and the input of R&D personnel should be increased, especially for the central and western regions, so that the proportion of personnel and funds in each region is balanced and innovation is promoted. Output, thereby improving the efficiency of the company's innovative resource allocation.

In the innovation output, only the number of patent applications in Shandong has been insufficient. It shows that although the sales revenue of new products of domestic enterprises in six provinces and cities in Shandong is insufficient, the shortage rate is 26.67%. Among them, the output of Heilongjiang and Sichuan is seriously insufficient, with 1757753.337 and 329.709 million yuan respectively. There are mainly 12 provinces and cities in the technology market, which indicates that local governments and enterprises should strengthen the activity of the technology market, promote technical exchanges, and improve the efficiency of innovation resource allocation.

Analysis of Factors Affecting the Efficiency of Enterprise Innovation Resource Allocation Based on DEA-Tobit

According to the results obtained in the previous section, taking the enterprise innovation resource allocation efficiency value as the dependent variable, select the X1-X15 influencing factor index of Table 2 as the independent variable, and use the state software to perform Tobit regression analysis on the relevant data, X1, X4, X5, X8 and X12 have significant results in the efficiency of enterprise innovation resource allocation (P<0.05). Other indicators have no significant impact on the efficiency of enterprise innovation resource allocation. The regression results show that the intensity of enterprise R&D capital investment, enterprise scale variables, enterprise technological innovation capability, economic level, and nationalization degree will affect the efficiency of enterprise innovation resource allocation. Among them, the coefficients of X1, X8 and X12 are negative, indicating that the strength of enterprise R&D capital investment, economic level and nationalization will not improve the efficiency of enterprise innovation resource allocation, but will reduce it. For the strength of enterprise R&D capital investment, enterprises investing too much R&D capital will often make the investment redundant, and in the case of insufficient output, it will reduce the efficiency of enterprise innovation resource allocation. The economic level of a region is known in Table 6-3. Using the DEA method to analyze its efficiency values, the economic level is not the determining factor determining the allocation of innovative resources in a region. The index coefficient of nationalization is negative, which reflects to a certain extent that the efficiency of innovation resource allocation of state-owned enterprises is mostly low. State-owned enterprises often have sufficient resources for innovation and have relatively good industrial policies, but the output of innovative resources is unclear. There is not enough innovation ability, and the efficiency of innovation resource allocation needs to be improved. The investment level of enterprise science and technology innovation and the regional R&D expenditure intensity coefficient show positive, indicating that technology is the primary productivity of enterprises and an effective driving force for enterprise innovation resource allocation. Enterprises to increase the corresponding investment in innovative resources and improve the level of science and technology will help improve the efficiency of enterprise innovation resource allocation.
Summary

For the region, the DEA effective regions are mostly in the eastern region, concentrated in developed cities such as Beijing, Zhejiang, Zhejiang, Chongqing, and some central and western regions, indicating that the efficiency of enterprise innovation resource allocation in the eastern cities is higher than that in the western regions. Developed cities have unique resources, economic conditions, and industrial policies. Although the results show that economic conditions are not necessary for the effective allocation of innovative resources, they are also catalysts. The overall efficiency, pure technical efficiency and scale efficiency of the eastern region are generally effective. The central and western regions are generally in an ineffective state of DEA, and the scale of returns is decreasing, indicating that the company's innovative resource allocation capacity needs to be improved. The government and local enterprises should work together to transform innovation. Resource allocation methods to improve the efficiency of innovation resource allocation. Although some regions show that DEA is ineffective, some regions are in a rising period and have good development prospects. Among them, Gansu's comprehensive efficiency and pure technical efficiency are not high. Qinghai's comprehensive efficiency and pure technical efficiency are lower than the average. However, there is still much room for improvement in the efficiency of enterprise innovation resource allocation in the two regions. The ability of enterprise innovation resource allocation is in a steadily rising state, and the government and enterprises should cooperate together. Change the direction of each investment and improve the efficiency of enterprise innovation resource allocation, so as to achieve DEA effectiveness. By empirically analyzing the influencing factors of the innovation resource allocation efficiency value of each region as the dependent variable, the results show that the impact of internal factors on the efficiency of enterprise innovation resource allocation is equivalent to the influence of external influence factors. Studies have shown that the growth capacity of enterprises, the level of education and the degree of openness in a region will not significantly affect the efficiency of innovation resource allocation in enterprises in the region. Among them, the coefficient of enterprise R&D capital investment intensity, economic level and nationalization degree is negative, indicating that these three will not increase the efficiency of enterprise innovation resource allocation, and the enterprise science and technology innovation input level and R&D expenditure input strength coefficient are positive, indicating that Both have a significant positive effect on the efficiency of enterprise innovation resource allocation. Enterprises can strengthen investment in science and technology and improve the research and development system in order to improve the efficiency of innovation resource allocation. Regional governments should reduce the degree of nationalization, enhance their ability to innovate, and change the way in which state-owned enterprises allocate innovative resources.

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References

