Study on Selection Index System of Leading Industries under Requirements of Sustainable Development Outlook

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Abstract

This article elaborates connotation and characteristics of leading industries, and summarizes selection norm of leading industries under requirements of sustainable development outlook. Then, the authors establish selection index system for leading industries and provide theoretical evidence for further rational determination of leading industries in economic development.

Keywords: Leading industry, Sustainable Development Outlook, Selection norm, Index system

1. Introduction

Leading industries have obvious forward, backward and side linkage effects in industrial economy system, and play a dominant and driving role for other industries, which decides that selection of leading industries has to correspond with development stage of regional economy and industrialization development level, and leading industries should have the fundamental conditions of self-development and the ability to drive economic development within the region. Selection of leading industries should fully reflect the principle of developing comparative advantages of all regions and industries and also the principle of competitive advantages, and satisfy basic requirements of sustainable development out, which has great significance to establishment of labor division system of rational regional industry and realization of sustainable and coordinated development of regional economy. Once a leading industry is selected, then the government will grant positive support to its development in the policy. Therefore, rational and scientific selection of regional leading industries means a lot to the investment department of the government.

2. Connotation and characteristics of leading industries

2.1 Connotation of leading industries

The notion of "leading industry" was proposed by the American economist W.Rostow and was further analyzed in a systematic way. He firstly used the notion of "leading industry" to replace the concept of "economic basic sector", and in his cost theory of economic stages, he put forward systematically a relatively complete theoretical system of leading industries. Through differences in his study on efficiency of economic development in different countries, W.Rostow discovered that, at each stage in the process of economic growth, there were some industries that might drive development of other industries, which he termed as leading industries. Thus, he described relations between successive replacement of economic growth stages and successive changes of leading industries.

It is not difficult to discover from the miracle of successful economic recovery of Japan after World War II, formation and development of leading industries constitute a strong driving force for development of national economy. Especially for a developing country, existence of a rapidly developed leading industry directly determines success or failure of its economic surpassing strategy. According to analysis by W.Rostow, and based on development history of industries in Japan and Germany, etc, this article is going to attach new content to the notion of a leading industry. That is, leading industries refer to those industries which can effectively absorb new technical achievements in a particular historical period, have high growth rate and wide linkage effects, play a directive and driving role in industrial structure and economic development, and have expansive market prospect and technical progress capacity.

2.2 Characteristics of leading industries

The new concept of leading industries reflects the following significant characteristics. Firstly, leading industries are highly advanced in terms of technology, have the functions of competing outside and driving development of regional industries, and can maintain strong innovation capacity and sustained section growth rate. Secondly, leading industries function well, able to become industries that can satisfy internal demands of a region and assume exported-oriented functions and tasks, have strong diffusion effects on other industries within the region, able to drive growth of other industries by various means, and can exert extensively direct and indirect influences on growth of other industries. Finally, in terms of time, leading industries are time-phased, and may be replaced by other leading industries with continual conversion of regional economic development and with different periods of regional economic development.

3. Selection norm of leading industries under requirements of sustainable development outlook

3.1 The norm to correspond with economic development stages

As for substantive characteristics of leading industries, they are not selected artificially, but are automatically formed in the process of economic development due to favorable market prospect. Level of people's production and living demands determines stages of economic development and leading industries that play a dominant and driving role in each development stage. It is required that confirmation of leading industries should start from demands of the market, and have steady market demands and large capacity of the market, together with firm foundation and good development conditions. Emphasis on decisive effect of economic development stages on leading industries does not necessarily mean going through channels of development modes in advanced industrialized countries. When conditions are fulfilled, it is totally possible to break through limitations of development stages in a country and within a region, and to select most appropriate leading industries. However, if we artificially drive up stage levels of economic development, and select those industrial sectors as leading industries that don't have conditions of sustainable and speedy growth themselves and conditions to drive sustainable development of regional industries and economy, then not only the industries themselves are obstructed as a result of insufficient social demands, but they cannot generate associative effects on other sectors or drive their development because of inadequate association with other sectors. Therefore, selection of leading industries has to correspond with industrialization level and stages of economic development.

3.2 Norm of dynamically comparative advantages

All regions are different from each other in terms of natural resources, manpower resources, scientific resources and economic & technical conditions. Dynamically comparative advantages require us to start from objective regional economic advantages, to combine progressive process and corresponding potential capacity of industrial technology within a region based on the pattern of specialized labor division in all industrial regions and based on macro-industrial policies, to follow demand orientation, to make the most of advantages and to maximize favorable factors and minimize unfavorable factors to select regional leading industries that can bring comparative benefits. Besides, major development direction of leading industries should be regulated based on stages. Dynamically comparative advantages can be measured through a great many relative indices, specifically including:

$$\text{Location quotient of output} = \frac{\text{Ratio of output of an industry within the region to that in the whole country}}{\text{Ratio of population within the region to that in the whole country}} \quad (1)$$

If the value of this index is above 1, then it is indicated that, in addition to satisfying internal demands of the region, the industry is also involved in foreign trade. The large the ratio, the larger comparative advantages of the industry, and the higher its industrial specialization and characterization level.

$$\text{Specialization rate of output} = \frac{\text{Ratio of output of an industry within the region to that in the whole country}}{\text{Ratio of output of all industries within the region to that in the whole country}} \quad (2)$$

The larger the value of this index, the higher the specialization rate of the industry, so it has comparative advantages in the whole country.

$$\text{Contribution rate of an industry} = \frac{\text{Value added to output of an industry within the region}}{\text{Value added to output of all industries within the region}} \quad (3)$$

The larger the value of this index, the larger its contribution to economic development within the region.

3.3 Norm of economy of scale

Scale of an industry is an important symbol to measure industrial development, and it is not only reflection of current development level of the industry, but also lays a firm foundation for its development in the future. Whether an industry

is a leading industry is determined primarily by its development scale. Economic benefit of an industry is an important reflection of its development performance, because it is not only an objective reflection of its current business performance, but realistic reflection of its competitive strength. Economic benefit of an industry is an important index to evaluate whether it can be regarded as a leading industry. However, usually contradiction is inevitable between scale and benefit. An industry which is large in scale but lags in benefit can bring nothing but waste of social resources, whereas an industry which is small in scale but brings much benefit usually costs a lot in industrial training. Hence, a regional leading industry has to correspond with the norm of economy of scale, and an industry which has both an appropriate scale and a considerable economic benefit can be selected as a leading industry.

Indices to measure development scale of an industry

$$\text{Ratio of output scale} = \frac{\text{Output of an industry within the region}}{\text{Total output of all industries within the region}} \tag{4}$$

$$\text{Ratio of sales income} = \frac{\text{Sales income of an industry within the region}}{\text{Total sales income of all industries within the region}} \tag{5}$$

$$\text{Ratio of total assets} = \frac{\text{Total assets of an industry within the region}}{\text{Total assets of all industries within the region}} \tag{6}$$

$$\text{Amount of profit and tax} = \frac{\text{Profit and tax of an industry within the region}}{\text{Profit and tax of all industries within the region}} \tag{7}$$

$$\text{Fixed assets ratio} = \frac{\text{Total fixed assets of an industry within the region}}{\text{Total fixed assets of all industries within the region}} \tag{8}$$

The larger the value of the above five indices measuring development scale of an industry, the stronger its industrial advantages in scale.

Indices to measure economic benefit of an industry

$$\text{Labor productivity of total output} = \frac{\text{Total output of an industry within the region}}{\text{Average number of all employers in an industry within the region}} \tag{9}$$

$$\text{Output rate of fixed assets} = \frac{\text{Output of an industry within a region}}{\text{Total fixed assets of the industry within a region}} \tag{10}$$

$$\text{Profit-tax rate of output} = \frac{\text{Total profit-tax amount of an industry within a region}}{\text{Total output of all industries within a region}} \tag{11}$$

$$\text{Profitability of output} = \frac{\text{Sales profit of an industry within a region}}{\text{Total output of all industries with a region}} \tag{12}$$

The larger the value of the above four indices measuring economic benefit of an industry, the better its economic benefit.

3.4 Norm of industrial associative strength

Industrial association refers to technical structure and product demand structure between different industrial sectors in social production, and is a spatial structure condition of social productivity development. Industrial associative strength refers to diffusion degree of technical structure and product demand structure between different industries and the

degree of interdependence and mutual driving. Selection of a leading industry should give priority to those industries with strong industrial associative strength. Since leading industries have strong forward, backward and side linkage effects, development priority should be given to industries with high associative strength. Then, the leading industry can drive and promote development of other industries, so that the chain reaction may be generated in economic development and economic development can be accelerated. Indices to measure associative strength of an industry are as follows: the influence coefficient and sensitivity coefficient can be calculated by Leontief inverse matrix coefficient in the input-output table.

$$R = (1 - A)^{-1}$$

R stands for Leontief inverse matrix coefficient; r_{ij} stands for elements in the i th row and j column of Leontief inverse matrix R, with an economic meaning of all due products in sector i for per unit final product in sector j.

Influence coefficient (RF_j), refers to degree of production changes in other relevant industries caused by production changes in an industry, that is, the degree of associative relation with other industries through supply.

$$RF_j = (\sum_{i=1}^{n} r_{ij} / n) \Big/ (\sum_{j=1}^{n} \sum_{i=1}^{n} r_{ij} / n)$$

Sensitivity coefficient (RB_j) refers to the degree of production changes in an industry caused by production changes in other industries which provide input products to the industry, that is, the degree of associative relation with other industries through demand.

$$RB_j = (\sum_{j=1}^{n} r_{ij} / n) \Big/ (\sum_{i=1}^{n} \sum_{j=1}^{n} r_{ij} / n)$$

If both of the above coefficients are larger than 1, then it is indicated that spread effect of the industry is larger than average value of all industries. Industries with significant spread effect should be selected as leading industries.

3.5 Norm of industrial development potential

Development potential here refers to the fact that, development of an industry has a broad prospect for economic growth of the society and can provide long-term influential strength for the overall development of industrial system. Based on this norm, in industrial construction, we should focus on selection and development of those industries that have significant meaning to overall development of the industrial system. Development potential of an industry is reflected in its market competitive strength and industrial growth. If a leading industry is going to play a dominant role and to drive development of other sectors, then first of all, it is required that its own products should have a broad market prospect and large capacity of the market, which is a precondition for its continual development and dominant role. Major indices to measure development potential of an industry are as follows:

Coefficient of income elasticity of demand: $e_i = \dfrac{\Delta Q_i / Q_i}{\Delta N_I / N_I}$

In the formula, $\Delta Q_i / Q_i$ refers to growth rate of demand on products of i th industry; $\Delta N_I / N_I$ refers to growth rate of income of national citizens.

If coefficient of income elasticity of demand is larger than 1, then it is indicated that an industry has high resilience; on the contrary, it coefficient of income elasticity of demand is smaller than 1, then it is indicated that the industry is lacking in resilience. Those industries with high resilience should be selected as leading industries.

$$\text{Market share} = \frac{\text{Annual sales income of products of an industry within a region}}{\text{Annual sales income of products of the industry in the whole country}} \tag{13}$$

The larger the value of this index, the larger its external demand strength, and the stronger its market competitive strength.

$$\text{Growth rate of output} = \frac{\text{Current output of an industry within a region-output of the industry at the same period the previous year}}{\text{Output of the industry at the same period the previous year}} \tag{14}$$

The larger the value of this index, the stronger its development capacity in economy.

$$\text{Growth rate of sales income} = \frac{\text{Current sales income of an industry within a region-sales income of the industry at the same period the previous year}}{\text{Sales income of the industry at the same period the previous year}} \tag{15}$$

The larger the value of the index, the stronger its growth potential and its sustainability.

$$\text{Comparative Labor Productivity} = \frac{\text{Ratio of output of an industry within a region to total output of all industries}}{\text{Ratio of labor force of the industry to total social labor force within the region}} \tag{16}$$

If the value of the index is larger than 1, then it is indicated that, labor productivity of the industry is above the average level of labor productivity of all industries within the region. The larger the value of the index, the higher the possibility of its labor productivity growth, and the faster the expansion of industrial market demand.

3.6 Norm of technical innovation

Technical progress and innovation is the motive and soul for sustainable development of modern economy under requirements of scientific outlook on development. Those industries with fast technical progress have huge potential to increase productivity, able to maintain fast growth within a period of time, save energy and materials, reduce cost, increase output, enhance quality, realize mass production and sales, and acquire economy of scale. Therefore, leading industries should reflect major direction and development trend of technical progress, and have strong potential of advanced technology. Then, they can facilitate speed of overall technical progress of all industries within a region, enhance labor productivity of all industries, increase technical value added of products, and occupy a favorable position in market competition. Indices to measure technical innovation of an industry is as follows:

$$\text{Contribution rate of technical progress} = \frac{\text{Growth rate of all output of an industry} - \alpha \times \text{growth rate of capital investment} - \beta \times \text{growth rate of labor force}}{\text{Growth rate of all output of the industry}} \tag{17}$$

In the formula, α stands for coefficient of income elasticity of capital (0.3-0.4) and β stands for coefficient of income elasticity of labor (0.7-0.6), $\alpha + \beta = 1$.

The index indicates contribution of technical progress factors to economic growth in addition to labor force and capital growth. The larger the value of the index, the larger its technical progress contribution rate.

Growth rate of total factor productivity: $r = \sqrt[n]{\dfrac{L^t}{L^0}} - 1$

In the formula, L^t stands for labor productivity of an industry in the report period; L^0 stands for labor productivity of the industry in the base period; n stands for the number of year intervals between report period and base period. Labor productivity refers to ratio of total output of the industry to total labor force of the industry.

Those industries with rapid rise in productivity have a production cost reduced rapidly, and such industries occupy more and more advantages in relative national income, qualified to be selected as leading industries.

3.7 Norm of sustainable development

Sustainable development outlook of economy requires that, selection of leading industries should not only consider economic factors, but also should take into account environmental and social factors to realize overall and harmonious development. Input factors of leading industries should be sustained within a long period of time, so that constancy of input and supply of leading industries can be guaranteed and sustained growth of economy can be ensured. Selection of leading industries for sustainable development of economy in a new era should highlight the concept of "green", and give priority to those industries that have high output, low pollution and eliminate exhaust of environmental pollutants in production progress, in addition to consideration of economic efficiency. Development of leading industries should not be based at the cost of ecological environment, and should be based on comprehensive and deep analysis of their environmental impacts and resource consumption. At the same time, social stability and development provides healthy and favorable guarantee for sustainable development of economy, so economic development should also promote increase of people's living conditions and progress of the society. Therefore, selection of leading industries should take into account all due contributions to social progress, and especially, evaluation of significance of industries should be conducted from the dimension of industrial human resource utilization.

Indices to measure industrial environment and sustainable development of the society include:

$$\text{Energy consumption per unit of output value} = \frac{\text{Energy consumption amount of an industry within a region}}{\text{Total output of the industry within a region}} \quad (18)$$

The smaller the value of the index, the fewer the energy consumed per unit of output value, the higher the degree of rationalization of energy structure and the higher the efficiency of energy utilization, which are requirements for leading industries in a new era.

$$\text{Employment absorption capacity} = \frac{\text{Quantity of employment of an industry within a region}}{\text{Total quantity of employment of all industries within a region}} \quad (19)$$

The larger the value of the index, the stronger its ability to allocate employment of social members and the more favorable for social stability and steady living of people, which are requirements for establishment of a harmonious society. That is, a leading industry should have strong ability to allocate employment.

$$\text{Per capital income proportion} = \frac{\text{Per capita income of an industry within a region}}{\text{Quantity of employment of all industries within the region}} \quad (20)$$

The larger the value of the index, the larger its contribution to people's income resources and to guarantee and increase of people's living conditions, which reflect contributions of the leading industry to the society.

$$\text{Investment and employment opportunities} = \frac{\text{Quantity of employment of an industry within a region}}{\text{Total investment amount of fixed assets of the industry}} \quad (21)$$

The larger the value of the index, the more the investment in the industry and the more opportunities to offer employment for the society, which reflect the driving force of the leading industry in upgrading civilization degree of a city, absorbing employment, encourage development of commerce and other service industries.

4. Establishment of selection index system of leading industries

Since there are various factors that affect selection of leading industries, we should first select corresponding indices with strong associative strength from complicated factors and variable indices based on definite norms and establish a comprehensive index system that can measure significance of leading industries. Then, a dependable platform can be established for selection of leading industries.

According to requirements of selection norms for leading industries, this article puts forward a set of selection index system for leading industries that corresponds to sustainable development of the society, as is shown in Figure 1.

Selection index system of regional leading industries takes into full consideration the selection norms of leading industries, and more specifically refines a comprehensive selection norm, which can be regarded as evidence for rational determination of leading industries.

5. Conclusion

Under requirements of sustainable development outlook, leading industries plays a highly driving role in economic development. A rational norm of selecting leading industries and establishment of effective selection index system contributes to more accurate positioning of leading industry structure, and to evaluation of development direction of leading industries, which can lay a foundation for better economic development.

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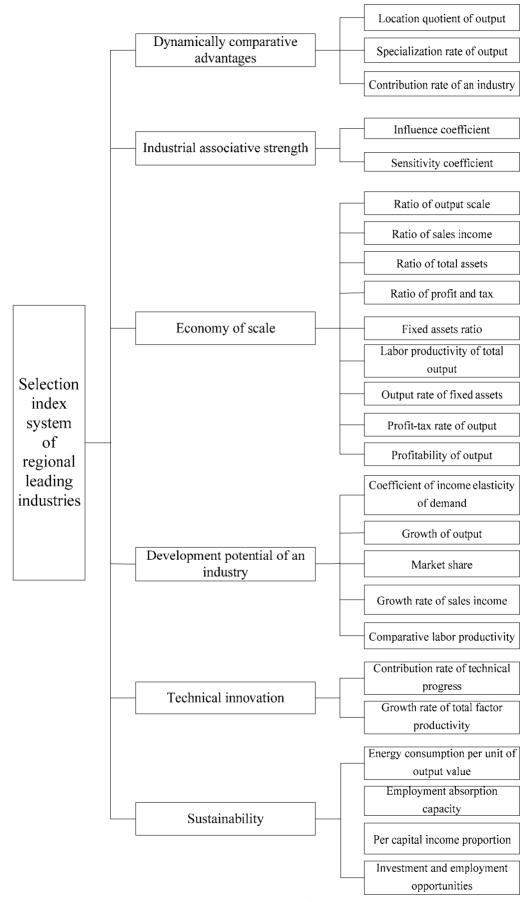Zhu, Yaowu & Zhu Yuneng. (2003). Selection Norms of Regional Leading Industries. *Shanghai Economic Forum*, (11).

Figure 1. Selection index system of leading industries