

Research on Undertaking Ability of China's Processing Trade Industries

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Abstract. Enterprises in central and western regions undertake industries from eastern region enterprises according to their own advantage, which would promote their own economic development and narrow the economic development gap between eastern region, central region and western region. By analyzing the factors affecting enterprises' undertaking ability in central and western regions using principal component analysis, undertaking regions' undertaking ability can be obtained which can provide some reference for the national industry planning.

Introduction

In the process of reform and opening up, China's coastal areas have developed into processing trade industrial agglomeration area with preferential policies, abundant and cheap labor, land resources and location advantage of waterfront. Processing trade industries mainly concentrate in traditional industries, and, after years of development, they have formed a large scale of economy and their own brand.

But along with the rapid development of economy in eastern regions, some problems have emerged. Problems like insufficient resources, the rise of land prices and labor shortages, have hindered the further development of industry. There are a lot of high energy consumption and low value added industries in eastern region which influence the overall development of the regional economy. By transferring backward industries, the enterprises in eastern region can develop high-end sectors and optimize the industrial structure. In addition, the low labor cost competition from surrounding countries also makes the profit of processing trade industry in eastern region becomes less and less. Part of the processing trade industries transfer away from the eastern regions can reduce the cost and expand the enterprise's profit space.

From the perspective of transfer industry, the transfer mainly concentrates on labor-intensive industries and resource intensive industries. Labor intensive industry depends on low cost labor, but owing to the rising cost of labor many labor-intensive industries in eastern regions choose to transfer to central and Western regions with relatively low labor cost. Compared with the eastern regions, the central and western regions are rich in natural resources, which have great attraction for resource dependent industries.

The labor-intensive industries undertaken by the central and western regions can greatly promote employment opportunities. Furthermore, a portion of talents of the first gradient areas with advanced business philosophy, advanced management experience are introduced which improves the overall quality of labor force in the central and western regions.

Capital investment from industry transfer region can make up for the funds shortfall, which provides some support for the stable economic growth of industry undertaking region. There are technology spillover effects during the industrial transfer process of eastern region. By leveraging cost advantage, combined with advanced technology, the enterprises in industry undertaking regions can achieve long-term development.

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There are some energy-intensity enterprises and heavy pollution enterprises in eastern region. Owing to resource scarcity and strict environmental legislation, these enterprises have to move out in order to survive. In order to promote economic growth, the central and western regions introduced many enterprises which can increase revenue but also pollute environment seriously. These industries would hurt the local environment, and the economic development of the central and western regions would fall into a vicious cycle.

Literature Reviews about Industrial Gradient Transferring and Principal Component Analysis

Vernon L. Smith brought forward the product life cycle theory in 1960s, later the further development by Wells and Hirsh in the second half of the twentieth century. The theory formed gradient transfer theory of regional economic development gradually. According to this theory, a region's economic gradient depends on the region's industrial strength, and the industry transfer trend is from high gradient regions to low gradient regions.

In the early 1980s, the gradient transfer theory was introduced into China (Xia Yunong, He Zhongxiu, 1982; Liu Guoguang, 1983) and many domestic scholars studied at it. Chen Gang, Chen Honger (2001) studied regional industrial transfer's influence on both industrial transfer regions and industrial undertaking regions. Dai Hongwei, Tian Xuebin and Chen Yongguo (2003) measured the industrial gradient coefficient using location quotient and comparative labor productivity. Chen Rui, Xiong Bilin (2007) analyzed the key factors affecting the industrial transfer, and industrial transfer's implementation mechanism under the influence of government and the market rules tested by a modified industrial gradient coefficient method. Ma Tao, Li Dong, et al. (2009) evaluated the industrial undertaking ability of all regions in China from the perspective of industrial division. An Zengjun, Yang Min (2013) constructed an analytic hierarchy process model of evaluating cross strait industrial transfer effect, and put forward the suggestions of cross-strait industrial transfer direction and mode on the basis of empirical results.

Research on Industrial Undertaking Ability of China's Central and Western Regions

We can get which factors influence industrial undertaking ability of a region and the industrial undertaking capacity situation of the second and third gradient regions by principal component analysis. So the industrial undertaking regions can pay attention to the factors affecting industrial undertaking effect, and the analysis results can provide some references for the selection of key industrial undertaking regions.

The Selection of Index and Data Source

Industrial Gradient Coefficient. A country or a region's industrial gradient situation is related to its industrial structure, factor endowments and technological level closely. Industrial gradient is the premise of industrial transfer, and the economic development differences between regions are the objective basis of industrial transfer. Industrial gradient coefficient can be calculated in accordance to the following formulae.

The comparative labor productivity=the ratio of regional industrial output value to national industrial output value/ the ratio of region industrial practitioners to national industrial practitioners.

Location quotient=the ratio of regional industrial output value to gross regional product / the ratio of national industrial output value to gross domestic product.

Industrial gradient coefficient=location quotient×the comparative labor productivity

Principal Component Analysis. In order to fully reflect the industrial undertaking ability situation of central region and western region, four first grade indexes and eleven second grade indexes are selected. The eleven indexes are: R&D personnel ratio (X_1), R&D expenditure ratio (X_2), R&D projects ratio (X_3), Length of Railways in Operation (X_4), Total Length of Highways (X_5), Freight traffic (X_6), Ratio of Total Assets to Industrial Output Value (X_7), Ratio of

Profits to Industrial Cost (X_8), Proportion of Products Sold (X_9), Energy Consumption per Unit of GDP/GRP (X_{10}), Electricity Consumption per Unit of GDP/GRP (X_{11}). Indexes data comes from China statistical yearbook on science and technology, China Statistical Yearbook and Provincial Statistical Yearbook yearly.

TABLE 1 INDUSTRIAL UNDERTAING ABILITY INDES

First grade index	Second grade index	Index explanation
Technological Index	R&D personnel ratio	R&D personnel refer to the personnel involved in research and experimental development research, management and support work which is an internationally comparable indicator of S&T manpower input. R & D personnel ratio is regional R & D personnel accounted in national R & D personnel.
	R&D expenditure ratio	R & D expenditure ratio is regional R & D expenditure ratio accounted in national R & D expenditure ratio.
	R&D projects ratio	R & D projects ratio is regional R & D projects ratio accounted in national R & D projects ratio.
Logistics Index	Length of Railways in Operation	Length of railways in operation refers to the total length of the trunk line under passenger and freight transportation (including both full operation and temporary operation). The length of railways in operation is an important indicator to show the development of the infrastructure for the railway transport, and also the essential data to calculate volume of passenger freight transport, traffic density and utilization efficiency of the locomotives and carriages.
	Total Length of Highways	Total length of highways refers to the length of highways which are built in conformity with the grades specified by the highway engineering standard formulated by the Ministry of Communications, and have been formally checked and accepted by the departments of highways and put into use. The length of highways is an important indicator to show the development of the highway construction and to provide essential information to calculate the transport network density.
	Freight traffic	Freight traffic refers to the volume of freight transported with various means. The freight traffic provides a quantitative measure to show how the transport industry serves the national economy and people, and is also an important indicator for planning the transport industry and for studying the development scale and speed of the transport industry.
Capital Efficiency Index	Ratio of Total Assets to Industrial Output Value (%)	Ratio of total assets to industrial output value reflects the profit-making capability of all assets of the enterprise and is a key indicator manifesting the performance and management and evaluating the profit-making potential of the enterprise.
	Ratio of Profits to Industrial Cost	Ratio of profits to industrial cost refers to the ratio of profits realized in a given period to the total costs in the same period, which reflects the economic efficiency of input cost.
	Proportion of Products Sold	Proportion of products sold refers to the ratio of total sales in a given period to the gross output value in the same period, which reflects the extent of industrial output sold.
Energy Index	Energy Consumption per Unit of GDP/GRP	Energy consumption per unit of GDP/GRP refers to the energy consumption per unit of gross domestic product in a country or the gross regional product in a region in the same reference period.
	Electricity Consumption per Unit of GDP/GRP	Electricity consumption per unit of GDP/GRP refers to the electricity consumption per unit of gross domestic product in a country or the gross regional product in a region in the same reference period.

Empirical Analysis

Industrial Gradient Coefficient

Thirty-one provinces, municipalities and autonomous regions of China are divided into three gradients by analyzing China's processing trade industrial conditions which is identical with the eastern region, the central region and western region geographical. Among them, the first gradient includes ten provinces, the second gradient includes fourteen provinces, and the third gradient includes seven provinces and cities.

TABLE 2 CHINA'S PROCESSING TRADE INDUSTRIAL GRADIENT SITUATIONS OF 2012

The first gradient		The second gradient		The third gradient	
Province	Industrial gradient coefficient	Province	Industrial gradient coefficient	Province	Industrial gradient coefficient
Liaoning	1.1371	Guangdong	0.6196	Hebei	0.0190
Gansu	1.5301	Yunnan	0.9656	Shanxi	0.0352
Anhui	1.2652	Heilongjiang	0.7998	Tibet	0.0596
Hubei	1.4213	Sichuan	0.8027	Henan	0.0851
Tianjin	1.8489	Shaanxi	0.8867	Beijing	0.2649
Jilin	1.6698	Fujian	0.9654	Guizhou	0.5208
Jiangxi	1.7061	Hainan	0.9784	Chongqing	0.5223
Jiangsu	1.7266	Qinghai	0.9832		
Shandong	2.7701	Shanghai	1.0187		
Zhejiang	2.9424	Xinjiang	1.0196		
		Hunan	1.0291		
		Ningxia	1.0630		
		Guangxi	1.0880		
		Inner Mongolia	1.1183		

Principal Component Analysis

Indexes are divided into four groups, among which, X_1 to X_3 represents science and technology, X_4 to X_6 represents logistics situation, X_7 to X_9 represents capital cases, X_{10} and X_{11} represents energy situation.

When analyze problems with principal component analysis, there is a problem of direction and magnitude's different between indexes. In order to achieve comparability between indexes, the first step is normalizing the data.

The principal components can be extracted when there is correlation between indexes. KMO statistics and Bartlett's test can test whether the indexes are suitable for principal component analysis, and the indexes pass the test.

Four principal components can be extracted from the four group indexes according to the characteristic roots situation, which means the four principal components would represent the data information of the original eleven indexes.

The principal component formula can be obtained after calculating the data of initial factor loading matrix. Comprehensive principal component formula can be obtained weight according to the weights of the four principal components.

$$F_{2007} = 0.97033F_1 + 0.72579F_2 + 0.76445F_3 + 0.95325F_4$$

$$F_{2008} = 0.94531F_1 + 0.70655F_2 + 0.81609F_3 + 0.95081F_4$$

$$F_{2009} = 0.98804F_1 + 0.73977F_2 + 0.94868F_3 + ZX$$

$$F_{2010} = 0.99139F_1 + 0.73137F_2 + 0.94522F_3 + ZX$$

$$F_{2011} = 0.98841F_1 + 0.72689F_2 + 0.91765F_3 + ZX$$

$$F_{2012} = 0.98977F_1 + 0.74235F_2 + 0.84941F_3 + ZX$$

We can get the industrial undertaking ability situation of the second and third gradient from 2007 to 2012 by calculating.

TABLE 3 THE INDUSTRIAL UNDERTAKING ABILITY SITUATION OF THE SECOND AND THIRD GRADIENT

	2007		2008		2009		2010		2011		2012	
	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Beijing	6.19	1	-2.99	19	-3.99	20	-4.35	20	-4.22	20	-4.07	20
Fujian	1.30	7	1.14	7	1.36	5	1.34	5	1.40	5	1.47	6
Guangdong	-0.92	15	1.23	5	0.27	8	0.32	8	0.20	8	-0.21	11
Guangxi	0.21	12	1.40	4	1.98	4	2.17	4	1.98	4	1.75	4
Guizhou	3.12	2	3.02	2	0.9	7	1.23	6	1.26	6	1.09	7
Hainan	1.07	9	-1.72	17	-1.35	17	-1.36	17	-1.25	17	-1.65	16
Hebei	-0.18	13	-1.62	15	-0.92	15	-0.85	16	-0.50	13	-0.22	12
Henan	2.95	3	2.93	3	4.24	2	3.71	2	3.51	2	3.12	2
Heilongjiang	1.79	6	0.57	10	2.08	3	2.35	3	2.52	3	2.49	3
Hunan	2.12	4	5.69	1	7.08	1	6.99	1	6.53	1	6.86	1
Inner Mongolia	-0.72	14	-2.20	18	-1.34	16	-0.82	15	-1.03	16	-0.63	15
Ningxia	-1.04	16	-4.00	20	-2.45	19	-3.00	19	-2.94	19	-3.06	19
Qinghai	-1.15	17	-1.66	16	-1.54	18	-1.72	18	-1.78	18	-2.13	18
Shanxi	1.82	5	0.81	9	1.22	6	0.70	7	0.83	7	1.51	5
Shaanxi	-3.32	18	-0.31	13	-0.5	13	-0.12	10	-0.38	12	0.48	8
Shanghai	0.75	11	-0.74	14	-0.31	12	-0.43	14	-0.50	14	-0.28	13
Sichuan	-3.97	19	-4.13	21	-5.65	21	-5.62	21	-5.18	21	-5.01	21
Tibet	1.29	8	0.35	11	-0.12	10	0.07	9	0.09	10	0.45	9
Xinjiang	-4.83	20	1.17	6	-0.78	14	-0.15	12	-0.03	11	-0.60	14
Yunnan	-7.38	21	0.03	12	0.08	9	-0.32	13	-0.70	15	-1.68	17
Chongqing	0.88	10	1.02	8	-0.26	11	-0.15	11	0.19	9	0.31	10

In order to observe the industrial undertaking ability situation of the second and third gradient more clearly, we analyze the industrial undertaking ability of the second gradient region and the third gradient region respectively.

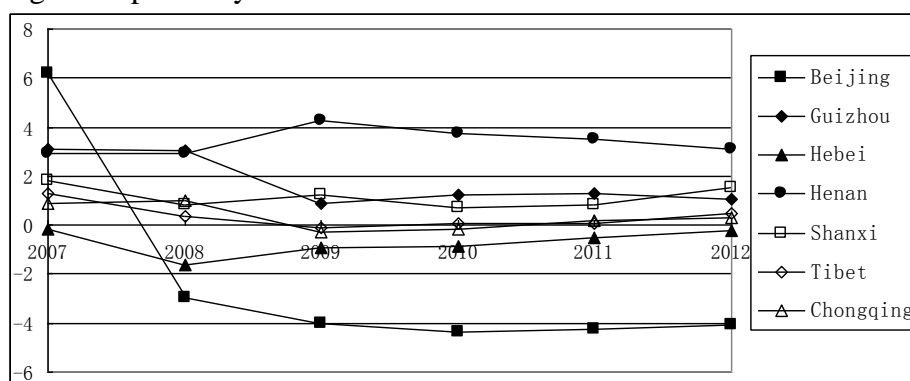


Fig 1. The Industrial Undertaking Ability of the Second Gradient From 2007 to 2012

As it can be seen from Figure 1, the industrial undertaking ability of Beijing, Guizhou, Henan, Chongqing and Tibet appear downward trend. The industrial undertaking ability of Hebei and Shanxi appear downward trend at first then they start showing an upward trend. The industrial undertaking ability of Henan is the strongest among the second gradient region, and the industrial undertaking ability of Beijing is the weakest among the second gradient region.

As it can be seen from Figure 2, the industrial undertaking ability of Hainan, Qinghai and Yunnan appear downward trend. The industrial undertaking ability of Fujian, Guangxi and Hunan appear upward trend. The industrial undertaking ability of Guangdong, Heilongjiang, Inner Mongolia, Ningxia, Shaanxi, Shanghai, Sichuan and Xinjiang show the state of twists and turns.

The industrial undertaking ability of Hunan is the strongest among the third gradient region, and the industrial undertaking ability of Sichuan is the weakest among the third gradient region.

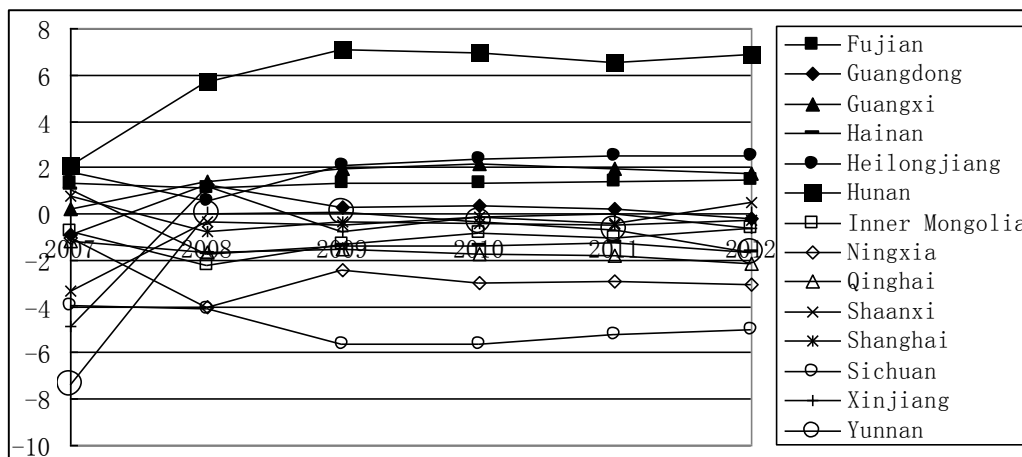


Fig 2. The Industrial Undertaking Ability of the Third Gradient from 2007 to 2012

Proposals on Promoting the Central and Western Regions' Industrial Undertaking

Improved Supporting Facilities

Convenient transportation facilities and efficient communications equipment are beneficial for enterprise's development, so it is necessary further increase infrastructure's investment in central region and western region.

On one hand, increase investment in various transportation lines.

Develop comprehensive transportation network focusing on highway, railroad and shipping. Reduce logistics costs and increase efficient interoperability between eastern region and central, western region by integrated transport system.

On the other hand, the second gradient region and the third gradient region need to increase investment on communication facilities, such as broadband network, optical fiber communication and mobile communications. Establish information resources sharing platform with the first gradient of region which is helpful for capturing market dynamics sharply. Meanwhile, industrial undertaking information network should be built which can provide advice for industrial transfer enterprises and reduce projects' dispersion and blindness by guiding the transfer industries to industrial agglomeration area.

Strengthened Talent Support

The gifted talent plays a very important role in the development of an enterprise, especially for the second gradient region and the third gradient region.

On one hand, the second, gradient region and the third gradient region need to attract high-quality personnel. Enterprises can attract talent with preferential recruitment conditions, such as solving family members' job and providing accommodation. And in order to train local personnel learning advanced technology, it is critical to invite outstanding entrepreneurs and professionals as technical instructor.

On the other hand, lay stress on the training of local talents. Increase capital investment on manpower to train the needed talent of enterprises. Enterprises should strengthen the link with universities and research institutes to develop needed human resources. Also, enterprises can sign oriented talent training plan directly with universities directly to culture targeted talent. Enterprises' innovation ability and industrial undertaking ability can be enhanced by improving quality of talent.

Protected Environments

The central region and western region should manage the relationship between economic development and environmental protection appropriately. We should assessing environmental

impact of the transfer projects, and limit the high pollution transfer industry effectively. It is necessary to pay more attention to the undertaking industry's scientific and technological content along with introducing the high-technology and less-pollution industry emphatically.

We should also emphasize enterprises' energy conservation. Enhance the enterprises' overall competitiveness and sustainable development by realizing low consumption, low emission and high efficiency during production process. To develop energy saving and emission reduction technology will be another ways and to provide technical guarantee for industrial undertaking by means of pollution prevention and control technology as well as ecological protection technology.

Conclusion

The industrial undertaking ability's analysis of central region and western region can provide references for the selection of industrial undertaking areas. Technological factors, logistical factors and capital efficiency factor play an important role in industrial undertaking ability. Energy factor also has an important influence on industrial undertaking ability. Yunnan, Xinjiang and Shaanxi's energy consumption are the most which appear upward trend, and Beijing's energy consumption is the least which shows downward trend. We should not only focus on improving technology, increasing capital, perfecting supporting facilities, but also lay stress on energy protection. Analyze regional planning of industrial undertaking comprehensively combining with various factors which impact industrial undertaking.

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