

Industrial structure change and regional creativity: mechanism analysis and empirical study

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Abstract:

The regional innovation system is an important part of the national innovation system. This paper expounds the mechanism of the regional innovation. The empirical results show that the industrial structure change has a significant positive effect on the regional innovation system.

Key words: *industrial structure change; regional innovation system; innovation subject; industrial development stage*

1. Introduction

With the rapid economic development, market-oriented reform in depth, China's industrial structure continued to optimize. In 2016, the tertiary industry output value increased by 384.221 billion yuan, but it is still very inadequate comparing with the developed countries. For example, the tertiary industry of US accounted for nearly 80% of GDP. Compared to US, China only some eastern region reached the average level of developed countries. Therefore, in recent years, industrial structure optimization and upgrading issues have been widespread concern.

China's economy has entered a period of new normal, which brings an opportunity for the development of industry and technological innovation. Under the new normal background, it is very important to promote the regional innovation through the change of industrial structure. However, most of the academic circles focus on the impact of innovation on industrial upgrading. Therefore, this paper discusses the main factors influencing the regional innovation of industrial structure change.

At present, the academic mainly discusses the impact of innovation on industrial upgrading. Azadegan et al.¹ used 353 manufacturer data for empirical analysis to show that firms could achieve higher levels of manufacturing and design through lower levels of manufacturing and design, and industrial upgrading had an impact on the firm's innovation performance. Expósitolanga et al.² proposed a complete perspective of the innovation process of industrial clusters, and explained the key issues in cluster research through network analysis techniques. Ge Qiuping et al.³ think that innovation-driven industrial upgrading is still China's future industrial upgrading policy objectives and focus.

2. Experimental

2.1 The influence of industrial structure change on the innovation of colleges

Universities and institutions are the main body of knowledge innovation and technological innovation output. Colleges and institutions do not only provide rich scientific research achievements, but also produce a large number of talents. The mechanism shown in Figure 1, can be analyzed from the following three angles:

From the micro perspective, the process of industrial structure change is from labor-intensive, capital-intensive to knowledge-intensive changes. It create demand for talent. The university will reform personnel training model according to market demand. According to the requirements of professional positions of the curriculum content of the rectification, training compound talents, and promote knowledge innovation.

From the perspective of the meso, the industrial structure changes along with the adjustment and optimization of industrial structure, to promote local industries from traditional industries to modern industries. Local governments for the promotion of the need to carry out political championships, to give local colleges and universities a lot of financial support to encourage colleges and universities to innovate; On the other hand, intergovernmental cooperation promotes regional innovation.

From the macro point of view, due to changes in industrial structure will inevitably active import and export trade, driven by international direct investment, technology and personnel and other elements of the flow of high courtyard access to foreign technology and knowledge spillovers; The other hand, the changes in industrial structure will lead to trade barriers. The importing country the importing country will restrict the imported goods, thus forcing export countries to enhance innovation and break trade barriers.

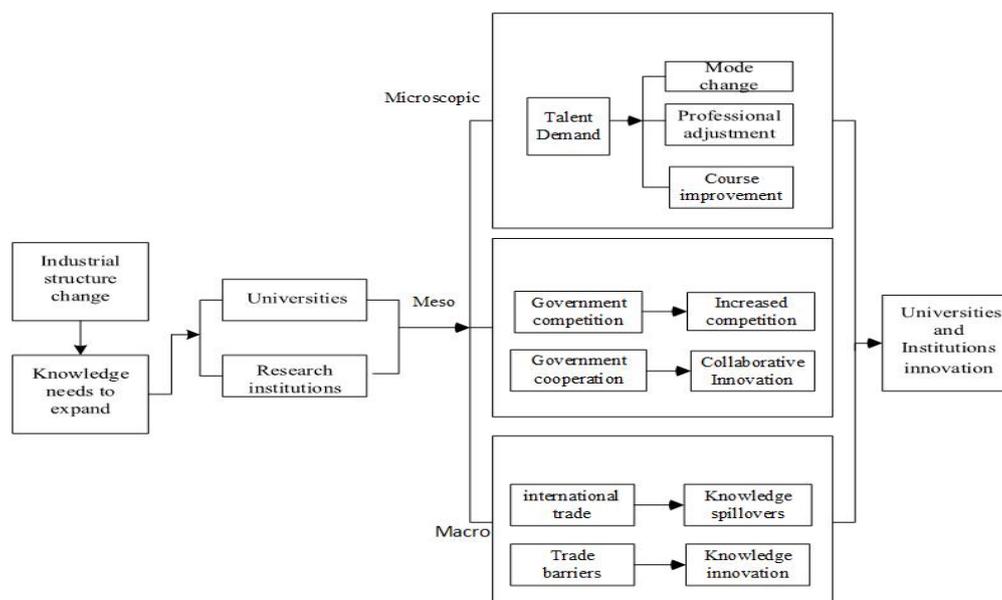


Figure 1. The Influence of Industrial Structure Change on the Innovation of Colleges

2.2 The impact of industrial structure change on enterprise innovation

The change of industrial structure can bring about the improvement of product added value,

the change of industrial structure and the adjustment of industrial layout. The mechanism of enterprise innovation is shown in Fig. 2, which can be analyzed from the following three perspectives:

From a micro perspective, industrial structure changes will inevitably lead to increased value-added products, product quality improved. So the market demand continues to expand, the enterprises obtain more excess profits. By the impact of market demand and interests, the potential competitors are increasing. In order to compete for market share and maximize the interests, it is necessary to carry out product innovation through the introduction of talents, technology, and information and so on.

From the perspective of the concept, the transformation and upgrading of the industry will inevitably lead to changes in industrial structure. Local governments to take appropriate policies to guide and regulate the corresponding, to create a characteristic industrial clusters. Industrial agglomeration produces positive externalities, such as reduce firm search costs, labor costs, and other costs, which make the enterprise better allocation of resources for product innovation. (Martin et al.⁴)

From the macro point of view, the change of industrial structure will inevitably lead to changes in industrial layout. On the one hand, the state will introduce the corresponding industrial policy, adjust the industrial layout, and promote industrial development, such as "one way" strategy, strategic emerging industry development plan "Internet +" industry action guidance and so on. On the other hand, the Industrial structure changes will be active import and export trade. It will promote the international capital, talent and other factors of production in the international flow, such as manufacturing, service outsourcing and FDI and so on.

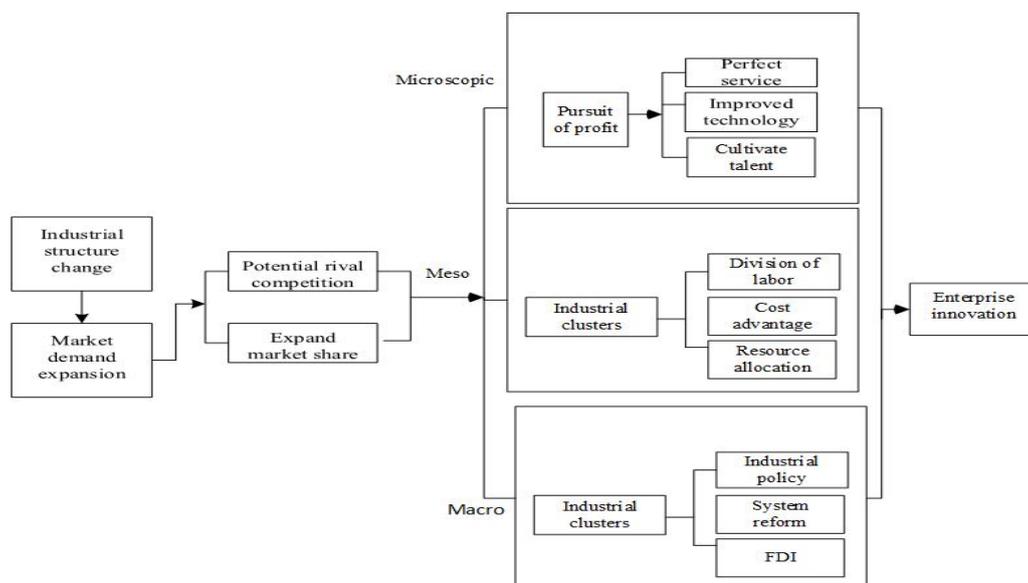


Figure 2. The impact of industrial structure change on enterprise innovation

2.3 Selection of variables

According to the purpose of this study, we will focus on the relationship between industrial

structure change and regional innovation, because innovation is also affected by financial environment, foreign direct investment and scientific research and other factors. So we make them as a control variable, the specific indicators Variables and meanings are shown in Table 1.

Table 1. Variable name and meaning

Variable Properties	Variable Name	Variable meaning
Explained variable	Knowledge innovation ability (KIA)	International Scientific Papers Published
	Technical innovation ability (TIA)	Invention patent authorization
	Product innovation ability (PIA)	Regulation of new business income
Explanatory variables	Secondary industry accounted (SIA)	Output value of the second industry /GDP
	The tertiary industry accounted (TTI)	Output value of tertiary industry /GDP
	Industrial structure change rate (ω)	arccos (Moore)
Control variables	Scientific research input level (SRI)	R&D /GDP
	Financial environment level (FEL)	Financial industry output value /GDP
	Foreign Direct Investment (FDI)	FDI

(1) Explained variables. As the main body of this study is universities, institutions and enterprises, so take the knowledge innovation ability, technological innovation ability and product innovation ability as the three explanatory variables. (Including SCI, EI and CPCI-S); The ability of scientific and technological innovation to measure the number of patents in the domestic invention; product innovation capacity is the rules of the new product income to measure. The above three indicators can better reflect the ability of regional innovation.

(2) Explanatory variables. There are three explanatory variables: the proportion of the secondary industry, the proportion of the tertiary industry and the efficiency of industrial structure change. Among them, the second and third industries mainly reflect the rationalization of the industrial structure; industrial structure change rate is proposed by *John*⁵ using a structural index of the industry, which can be used to study the process of structural change. This paper introduces it as one of the main explanatory variables, which is used to reflect the magnitude of the change of industrial structure. The main calculation principle is as follows:

$$M = \cos(\omega) = \frac{\sum_{i=1}^n \omega_{i0} \times \omega_{i1}}{\sqrt{\sum_{i=1}^n \omega_{i0}^2} \times \sqrt{\sum_{i=1}^n \omega_{i1}^2}} \quad (1)$$

Among them ω_{i0} represents the proportion of the i industry in the base period, ω_{i1} represents the proportion of the i industry in the reporting period, n is the number of industries, M is the Moore structural change value, ω is the angle between the two groups of two, ω indicates the change of industrial structure, the larger the ω , the more obvious the change of industrial structure.

(3) Control variables. Scientific research input level: scientific research investment has a direct link to innovation, so this article selected R & D / GDP to measure the level of scientific research. Financial development level: innovation in addition to relying on the government's capital investment, but also the need for social capital risk investment, so this paper uses the financial industry value / GDP to measure a region's financial development level. Foreign direct investment: In the previous analysis, FDI will generate knowledge spillovers and technology spillovers, which will have an impact on innovation, so this article will be included in the control variables.

2.4 Mathematical formulas and equations

Based on the existing literature, *Jaffe*⁵ uses the innovative input-output function as the most basic model, On both sides of the logarithm, the model rewritten as follows:

$$\ln TAI_{it} = \alpha_0 + \alpha_1 \ln SIA_{it} + \alpha_2 \ln TTI_{it} + \alpha_3 \ln \omega_{it} + \alpha_4 \ln SRI_{it} + \alpha_5 \ln FEL_{it} + \alpha_6 \ln FDI_{it} + \varepsilon_{it} \quad (2)$$

$$\ln KIA_{it} = \alpha_0 + \alpha_1 \ln SIA_{it} + \alpha_2 \ln TTI_{it} + \alpha_3 \ln \omega_{it} + \alpha_4 \ln SRI_{it} + \alpha_5 \ln FEL_{it} + \alpha_6 \ln FDI_{it} + \varepsilon_{it} \quad (3)$$

$$\ln PIA_{it} = \alpha_0 + \alpha_1 \ln SIA_{it} + \alpha_2 \ln TTI_{it} + \alpha_3 \ln \omega_{it} + \alpha_4 \ln SRI_{it} + \alpha_5 \ln FEL_{it} + \alpha_6 \ln FDI_{it} + \varepsilon_{it} \quad (4)$$

Where i represents the provinces, t stands for the time of year, $\alpha_1 \dots \alpha_6$ represent the elastic coefficient corresponding to each independent variable, ε_{it} is the random error term.

3. Results and discussion

In order to verify the impact of industrial structure change on regional innovation, we select the data from 30 provinces in China from 2004 to 2014, and the results are shown in Table 2.

Through the regression results we can find that: first of all, for the explanatory variables, the proportion of the second industry, the proportion of tertiary industry and industrial structure changes on knowledge innovation, technological innovation and product innovation are positive, and both in 1% and 5% Level, in the second and third industry transformation and upgrading process, the industrial structure changes can promote the enterprises, universities and institutions of regional innovation.

4. Conclusions

This paper analyzes the panel data of 30 provinces in China from 2004 to 2014, and gets the result that the change of industrial structure can affect regional innovation. In particular, for the early industrialization stage, to the secondary industry structure changes are more

conducive to the enterprise product innovation; In the middle of industrialization of, to the second industrial structure changes more conducive to technological innovation; For the late industrialization, to the tertiary industry structure change is more conducive to the knowledge innovation.

Table 2. National panel data regression

model	(2)	(3)	(4)
Constant term	16.721*** (15.862)	10.770*** (6.728)	18.632*** (10.796)
lnSIA	4.473*** (9.854)	2.212*** (3.210)	3.884*** (5.226)
lnTTI	5.831*** (11.114)	3.329*** (4.180)	5.180*** (6.032)
ln ω	0.233*** (4.589)	0.277*** (3.590)	0.188** (2.268)
lnSRI	0.139** (2.274)	0.296*** (3.194)	0.239** (2.397)
lnFEL	0.507*** (6.358)	1.054*** (8.702)	0.319** (2.443)
lnFDI	0.241*** (6.222)	0.494*** (8.400)	0.619*** (9.770)
Sample size	330	330	330
R ²	0.970	0.918	0.918
F	273.019	94.199	94.060

References

1. *Azadegan A, Wagner S M.* Industrial upgrading, exploitative innovations and explorative innovations. *International Journal of Production Economics*, 130(2011)54-65.
2. *Expósito-langa M, Tomás-miquel J, Molinamoraes F X.* Innovation in clusters: exploration capacity, networking intensity and external resources. *Journal of Organizational Change Management*, 28(2015)26-42.
3. *Ge Qiuping, Li Mei.* Study on China's Innovation-Driven Industrial Structure Change Policy. *Science and Technology Progress and Countermeasures*, 30(2013)102-106.
4. *Martin P, Mayer T, Mayneris F.* Spatial concentration and plant-level productivity in France. *Journal of Urban Economics*, 69(2011)182-195.
5. *Jaffe A B.* *Real Effects of Academic Research* . *American Economic Review*, 79 (1989)957-970