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The Impact of MNCs' R&D Centers Aggregation Level on Regional Innovation Capability

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Abstract. Based on the panel data of seven economically developed regions in China from 2006 to 2015, the STATA 15.0 is used to study the direct and indirect effects of the R&D center aggregation level on regional innovation capability by the fixed-effect regression method. The results show that, from its direct impact, active establishment of multinational companies R&D centers and their agglomeration would positively influence regional technological innovation ability. From the indirect effect, the aggregation of R&D center of MNCs improves regional innovation ability through the flow and agglomeration of talents, research and development funds. Finally, based on the research results, relevant suggestions are put forward.

1. Introduction

Innovation is the key to determining the competitiveness of a region. In order to further open up the host country market, multinational companies have been increasingly focusing on R&D in host countries. In recent years, more and more R&D centers, which possess advanced technology and research resources, have been established in China. The knowledge spillover effects they generate provides a good opportunity for improving regional technological innovation levels. However, because of the knowledge blockade and insufficient absorptive capacity of local companies, high-aggregation foreign R&D centers may cause pressure on local companies and negative effects such as the loss of talents and R&D resources.

In order to study how agglomeration of MNCs' R&D centers affects the innovation capability of a region, this paper selected seven regions in China, where the agglomeration effect of multinational companies' R&D centers is obvious, theoretically analyzes the impact mechanism of R&D center concentration on regional innovation capability based on provincial panel data from 2006 to 2015.

2. Literature Review

R&D centers refer to organizations that directly engage in research and development activities in the field of science and technology. At present, multinational companies have set up more than 2, 400 R&D centers in China, which are highly concentrated in economically developed areas.

There are studies believes that the intensive establishment of MNCs R&D centers by is conducive to accelerating the R&D investment structure optimization as well as upgradation of industrial structure, learning R&D management experience, improving the quality of technological talents, and facilitating the absorption of technology spillover effects from MNCs. However, at the same time there is a cheap use of labor force, which suppresses the formation of local industries, causing the loss

of talents and technical reliance in host country. Glass's research finds that it would not produce positive influence by foreign R&D centers without satisfying certain prerequisites. In addition, it is difficult for multinational corporations to transfer key technologies to host countries. Such technical monopolies will widen the gap of technological levels between countries, affect the confidence of local corporate innovation.

From the analysis of the above-mentioned literatures, it can be seen that the multinational R&D center does have a positive impact on the host country. However, the degree of positive impact and negative impact of agglomeration remains to be further examined, and the impact of the MNCs R&D center's agglomeration is multifaceted. Therefore, the author tries to analyze the influence of multinational R&D center agglomeration and its interaction with multiple factors on the regional innovation ability from the theoretical and empirical perspectives.

3. Mechanism of the Influence of MNCs R&D Center Agglomeration Level on Regional Innovation Capability

Fisrtly, MNCs R&D centers concentration level influences regional technological innovation capabilities through talent effect. Technicians who have worked or received training in multinational R&D centers will bring back advanced technology, knowledge, and management experience. With the increase in the concentration of multinationals' R&D centers, this talent effect will continue to expand and the spillover effects of R&D centers will increase accordingly.

R&D capital input is another channel to influence local enterprises. MNCs spend a lot of R&D investment in R&D centers to acquire new technologies and new products. According to statistics, with more than 400 foreign R&D center in Shanghai, foreign R&D funds accounted for almost 43.63% of the total R&D expenditures. The higher the concentration of the MNCs R&D center, the more R&D funds enter the region, which will have a optimization of the R&D investment structure.

Level of MNCs R&D centers concentration and regional economy have interactive influence on regional technological innovation capability, higher level of economic development means stronger ability to attract foreign capital and more intensive agglomeration of MNCs R&D centers, developed areas can also better imitate and learn advanced technology.

4. Model Design and Indicator Selection

4.1. Model setting, data sources and description

The author constructed the following specific economic model:

$$PAT_{i,t}=\gamma+\beta_1 L_{i,t}+\beta_2 K_{i,t}+\beta_3 FRDA_{i,t}+\varepsilon \quad (1)$$

$$PAT_{i,t}=\gamma+\beta_1 L_{i,t}+\beta_2 K_{i,t}+\beta_3 X_t\times FRDA_{i,t}+\varepsilon \quad (2)$$

In (1) (2), the subscripts i and t indicate the region and year respectively; ε represents the random error term. PATi, t represents technological innovation output, $K_{i,t}$ represents scientific research funding, $L_{i,t}$ represents R&D personnel, $FRDA_{i,t}$ represents the number of MNCs R&D centers in the region. This indicator is used to measure regional MNCs R&D center agglomeration level. The X in $X_t\times FRDA_{i,t}$ shows a series of regulatory variables, including: economic development level, labor capital stock, and capital stock of assets.This paper uses the data from Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Shandong, and Guangdong from 2006 to 2015 as a sample. Use the *xtscc* command of Stata.15 software to estimate the model.

4.2. Selection of Indicators

Explained variables: Technical innovation output, which is measured by invention patent grant amount. Explanatory variables: (1) the level of regions' MNCs R&D centers concentration, represented by the number of MNCs R&D centers set up by mutinationals in the region. (2) The human input, measured

by the number of R&D personnel in the innovation process. (3) The R&D funds investement, measured by the R&D expenditures of regions.

Interaction items: (1) Economic development level. Regions with higher level of economic development is able to imitate new technology faster. This variable is expressed by per capita GDP of seven regions. (2) Human capital. This paper uses the number of R&D personnel to measure regional human capital. (3) Capital investment, measured be regional R&D internal expenditure in this paper.

5. Empirical Results and Analysis

We used Stata.15 software to perform a fixed-effect regression and to handle the heteroscedasticity problem. The results of the regression tests are analyzed in Table 2, analyzing Table 2 draws the following conclusions:

The Model 1 shows that there is a positive spillover effect on regional innovation ability, the coefficient of MNCs' R&D center aggregation level is 0.01, while this effect is significant at the level of 0.1%. At present, China actively attracts multinationals to establish R&D centers locally is conducive to improving regional technological innovation capability. However, most of the R&D centers in China are on a low strategic position, so its contribution to local innovation ability is small. In addition, the monopoly of the key technology, the occupation of R&D resources and the large gap of technology also lead to insufficient spillover of R&D centers.

From model 2, 3, 4 and 5, it can be seen that the aggreagation of MNCs R&D center enhances regional capabilities through the flow of talents, promotion of R&D capital, and improvement of economy level. Model 2 shows that a 1% increase in the human capital stock will increase the regional patent output by 1.18%. There the increase in research personnel has expanded the effect of talents flow. Model 3 shows that foreign R&D centers have boosted the overall technological innovation capability of the region by increasing R&D investment in the region; taking Shanghai as an example, in 2010-2015, The foreign R&D funds accounted for 43.63% of the total R&D expenditure, which is related closely to more than 400 MNCs R&D centers in Shanghai. Model 4 adds the interaction item between economic development level and foreign R&D centers. The coefficient of interaction variables is very significant (0.993). This indicates that higher level of economic development will acquire more effect of this R&D spillover effect.

Table 1. Regression Results

Explained variables	Model 1	Model 2	Model 3	Model 4
The R&D funds investement	0.925*	0.458	0.278	0.311
	-2.71	-1.79	-2.22	-2.05
The R&D human input	0.226	-0.890**	0.0478	0.114
	-0.68	(-4.55)	-0.84	-1.52
MNCs R&D centers concentration	0.008**	0.00455*	-0.000005	0.00128
	-4.66	-2.43	(-0.00)	-0.89
Human capital*R&D centers		1.177**		
		-3.45		
Capital investment*R&D centers			0.803***	
			-9.03	
Economy level*R&D centers				0.993***
				-6.79
Constant Term	-6.922	-6.782*	-11.54***	-12.26***
	(-1.90)	(-3.10)	(-7.87)	(-7.45)
Sample	70	70	70	70
Within-R2	0.617	0.887	0.748	0.644

Among the control variables, both the R&D funds and the human capital input are estimated to be positive, with coefficient of 0.925 and 0.226 respectively. In contrast, the concentration level of foreign R&D centers contributes smaller to local innovation capacity. The probable reason is that the establishment of foreign R&D centers in the region is not well integrated into the local innovation system, and the local absorption capacity for its technological spillovers is still insufficient.

6. Conclusion and Recommendation

This paper studies the data of seven regions in China from 2006 to 2015, and comprehensively analyzes the impact of concentration level of multinational R&D center on regional innovation capacity. The main conclusions are drawn: From an overall perspective, high-level multinational R&D centers gathering has a positive impact on local innovation capacity, but the degree of influence is relatively small. However, the talent and capital effects brought about by this aggregation have a significant spillover effect on regional innovation and development. At the same time, region with high-level talent gathering, sufficient R&D capital and higher economy development can better absorb new knowledge and new technologies generated by foreign R&D centers as well.

In order to exploit full use of the positive effects of technological spillovers of foreign R&D centers on regional innovation capabilities, the author proposes the following suggestions: First, adjustment policies to attract more multinational corporations to establish R&D centers with high strategic status, provide supporting facilities as well as services to improve innovation and entrepreneurship environment, encourage cooperation between foreign and local enterprises, enable R&D centers to integrate into local innovation systems. Second, focus on and support the development of local SMEs and innovative companies, actively cultivate the sense of innovation and competitiveness of local companies so that we can realize innovation self-reliance and narrow the technological gap with foreign enterprises. Third, gradually increase the proportion of R&D funds to GNP, enhance the treatment of R&D personnel and increase investment in education, provide diverse advanced technology training opportunities to achieve more intensive and effective talent flow to meet the development needs of R&D and innovation.

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