Proceedings of Business and Economic Studies, 2025, Volume 8, Issue 2
http://ojs.bbwpublisher.com/index.php/PBES
Online ISSN: 2209-265X
Print ISSN: 2209-2641

Study on the Impact of Strong Provincial Capitals on Regional Innovation Efficiency

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Abstract: Strong provincial capital is an important initiative for underdeveloped regions to realize rapid regional economic development through leading by point, which is related to the overall situation of China's economic high-quality development. This paper theoretically analyzes the internal mechanism of strong provincial capitals affecting regional innovation efficiency. The study finds that the policy of strong provincial capitals promotes the formation of the resource aggregation effect in the capital cities, attracts talents, technologies, policies, and capital and other factors, improves the efficiency and quality of innovation, and drives the development of neighboring regions. However, over-implementation of the policy will lead to a large number of "big enterprises," which will lead to rent-seeking, waste of resources, crowding out of government subsidies and congestion effects, inhibit innovation, and lead to the loss of innovation factors in peripheral cities, dragging down the innovation level of the whole province. Therefore, the relationship between strong provincial capitals and innovation is an inverted "U" shape, and this study is of great significance for understanding the double-edged sword effect of strong provincial capitals and formulating scientific regional innovation policies.

Keywords: Strong provincial capitals; Regional innovation efficiency; Technological progress; Resource allocation; Growth poles

Online publication: April 28, 2025

1. Introduction

In recent years, many provinces have chosen to implement the "strong provincial capital" strategy as a key initiative to promote regional economic development, according to statistics, Changsha, Shijiazhuang, Fuzhou and other 14 provincial capital cities (more than half of the national provinces, autonomous regions, provincial capitals, capital city) has put forward the strategy, aimed at creating a strong resource allocation center, enhance The strategy aims to enhance comprehensive competitiveness by creating a strong resource allocation center, improving urban discourse, and taking advantage of the capital city's political, economic, and cultural center status, as well as infrastructure and human resources, to serve as the core engine of provincial development, and then drive the province's economic synergistic development through the radiative effect to achieve common prosperity [1-3].

Nowadays, innovation has become the core driving force for social progress and economic development and is also the core of China's new development concept, which is the key to promoting high-quality economic development. Therefore, in the context of the strategy of "strong provincial capitals," we cannot help but ask: Is the strategy of strong provincial capitals conducive to the promotion of innovative development? Can it effectively improve regional innovation efficiency? And how is the mechanism of strong provincial capitals' influence on regional innovation efficiency? These questions are not only related to the balanced development of China's regional economy, but also to China's position and prospects in global competition.

2. Literature review

2.1. Research on innovation

Innovative activities, unlike general production and business activities, are characterized by high inputs, long investment cycles, high risk of unstable investment results, and positive externalities of incomplete exclusivity of the results, but a large number of studies have concluded that innovation is an important source of economic growth. The endogenous growth theory suggests that technological innovation is a function of R&D funding and R&D personnel investment. However, innovation activities are not only affected by the innovation factors, i.e. R&D personnel and R&D inputs, but also by the innovation subjects, i.e. universities, research institutes, enterprises, etc., their characteristics, the market environment in which they are located and the government as a special economic unit [4,5].

Financing is the core problem of innovation activities, especially for innovation subjects such as universities, research institutions, and enterprises [6]. The limitations of internal financing make external financing critical. Through industrial policies such as R&D subsidies, tax breaks, and credits, the government not only provides direct resource support for enterprise innovation and reduces R&D costs but also attracts more investors with the help of the signaling effect, which enhances enterprises' confidence in innovation and the expected rate of return. However, government intervention may also bring problems such as information asymmetry, adverse selection, moral hazard and misaligned incentives, and even inhibit R&D investment and increase innovation costs due to the resource curse effect. In addition, the capital market, as another financing channel, expands financing channels through the allocation of financial assets by real enterprises, reduces information collection costs, and improves the efficiency of capital allocation. However, the market arbitrage motive may induce firms to neglect long-term R&D investment, weakening technological innovation capability. Market structure also affects innovation activities, with monopolistic firms and highly competitive market environments having their advantages. However, distorted factor markets can inhibit the rational allocation of resources, increase the cost of firms' access to innovation resources, distort the signaling mechanism of government subsidies, and make it more difficult for investors to identify firms with R&D potential. Finally, firm-level factors also have a profound impact on innovation activities, such as firm size, ownership, and corporate governance structure. Large monopolistic firms have an advantage in terms of R&D hardware due to their strength, while smaller firms may be more prone to technological breakthroughs due to organizational flexibility. In terms of corporate governance, the nature characteristics of the decision-making layer and management incentives determine whether firms are willing to carry out innovative activities with long-term value, which has a direct effect on encouraging managers to choose high-risk and long-cycle innovative activities and mitigating moral hazard [7-10].

To summarize, innovation activity is a complex process, which is subject to the joint effect of multiple factors such as innovation factors, market environment, government policies and enterprise characteristics. To promote innovation, it is necessary to consider these factors comprehensively, optimize the financing environment, improve the market structure, enhance the effectiveness and relevance of government policies, and at the same time

strengthen the construction of internal governance and incentive mechanisms of enterprises.

2.2. Research on strong provincial capitals

In the literature on strong provincial capitals, researchers mainly focus on their spillover and siphon effects to explore their impacts on the provincial capitals, neighboring cities, and the whole province. Strong provincial capitals, as agglomeration economies for provincial capitals, factor agglomeration may bring positive agglomeration effects, such as labor reservoirs, intermediate goods sharing, and knowledge and technology spillovers, but it may also produce crowding effects, leading to factor mismatch and rising production costs. For neighboring cities, it may produce spillover effects such as knowledge and technology diffusion and industry transfer or siphon effects such as talent and capital flight. For the whole province, the development of the provincial capital may either drive the province's development through radiation and diffusion or lead to unbalanced development due to policy and resource favoritism.

In terms of specific studies, Zhao *et al*. found that the industrial development of provincial capitals significantly drove the development of local cities, which manifested as a spillover effect. Wu *et al*. showed that the primacy of provincial capital cities has an "inverted U" effect on the level of economic development in the province. Fu *et al*. found that from the perspective of urban boundary expansion, in the long run, expansion has an inhibitory effect on the economic growth of the provincial capital. Wang *et al*. argue that the siphoning and spillover effects of provincial capitals vary in strength at different stages, and the timely implementation of the strategy of strong provincial capitals is conducive to narrowing the urban-rural income gap. Ding *et al*. found that in different primacy areas, city primacy has different effects on economic growth. In addition, scholars have studied the impact of strong provincial capitals on regional innovation capacity. Yang *et al*. found that strong provincial capitals have a significant role in promoting regional innovation performance, while Zhuang *et al*. found that the primacy of provincial capitals has an "inverted U-shaped" effect on the level of innovation development in the province, and a positive effect on the gap between the provincial capitals and non-provincial capitals in terms of innovation development [11-14].

In summary, the key to the study of strong provincial capitals lies in their spillover and siphoning effects, which have an impact on economic level, innovation level, and enterprise productivity. At the same time, to promote the development of the province as a growth pole, it is also necessary to consider the capacity of the neighboring regions, such as whether the overflow from the provincial capitals can be taken up by non-capital cities, and whether the excess factors will be attracted, etc., which are the issues that should be studied to realize regional development.

3. Analytical discussion

According to Schumpeter's hypothesis, large enterprises bear a larger proportion of the share of innovation, and the excess returns of innovation results also need certain market forces to ensure that the strong provincial capital is to build such "big enterprises" in the province. How to build such "big enterprises" in strong provinces? First, in terms of factor resources. The endogenous growth theory suggests that technological innovation is a function of R&D capital and R&D personnel input. Strong provinces will form a resource aggregation effect, attracting talent, technology, policy, and other factors to the provincial capital, forming a reservoir of labor, and attracting a large amount of capital to invest, providing sufficient factor reserves for innovation activities. In terms of capital factors, the policies of strong provincial capitals give more preferences to capital cities, such as R&D subsidies, tax breaks, relaxed credit and other policies to give more R&D funds to enterprises, easing their financing constraints; supplementing the resources needed for enterprise innovation, reducing the cost of private R&D, narrowing the

gap between the benefits brought by R&D activities to enterprises and the benefits to the society, raising the expected rate of return, and increasing the incentives for enterprises to innovate. In terms of R&D personnel, the economic agglomeration or industrial agglomeration brought about by strong provincial capitals creates a labor pool, improves the matching efficiency between enterprises and R&D personnel, and reduces the search cost brought about by information asymmetry. At the same time, the concentration of various talents provides researchers with opportunities for face-to-face exchanges, which contributes to the exchange and reorganization of tacit knowledge, i.e., the effective diffusion of knowledge and technology, leading to the rapid growth of R&D personnel's knowledge and skills, improving the quality of the workforce and accelerating the pace of innovation. A large amount of capital and high-quality labor force gathers in the provincial capital, which makes the provincial capital a "big enterprise" that becomes the innovation highland of the whole province and carries out innovation activities with higher efficiency and quality [15,16].

However, the excessive reinforcement of provincial capitals, which makes "big enterprises" too large, will hurt the overall innovation efficiency, and as stated in Wu Yanbing's review of the relationship between firm size and innovation, the relationship between firm size and innovation capacity is not a simple linear relationship. Based on the resource curse effect, abundant resources are more likely to trigger rent-seeking activities and resource wastage, and rent-seeking costs may crowd out R&D investment. Further, government R&D subsidies, too, may have a crowding-out effect on firms' R&D investment. On the one hand, due to the positive externality of innovation, unsubsidized firms may have "free-riding" behavior, leading to a decrease in R&D investment in the whole industry; on the other hand, government intervention increases the demand for innovation factors, which leads to higher prices and higher innovation costs, and reduces the innovation activities of firms. Secondly, when factors are overly concentrated in provincial capitals, it will weaken the positive externality of agglomeration, and it will produce a crowding effect and inhibit innovation. If the supply of factors exceeds the demand of the industry, the marginal contribution rate of factors will decline; excessive agglomeration of industries will intensify market competition, making it difficult to fulfill the excess returns gained by enterprises through innovation and making enterprises lack the incentive to innovate. At the same time, as the growth rate of the supply of infrastructure and public products in the city is much lower than the growth rate of factors, it makes all kinds of environmental costs increase, and their prices deviate greatly from the value, which contributes to the confusion of resource allocation, and is not conducive to the development of innovative activities. In addition, from the perspective of the entire province, the innovation factors of the peripheral cities have flowed into the central region in large quantities, and they lack the necessary factors to undertake the overflow of knowledge and technology, failing to keep up with the development of the central cities and gradually disconnecting from the production and operation of the central region. The technology in the peripheral areas cannot be updated and will gradually be eliminated by the market, dragging down the innovation level of the province. Therefore, this paper concludes that there is an inverted U-shaped relationship between strong provincial capitals and innovation [17,18].

4. Conclusions and recommendations

This paper explores in depth the impact mechanism of the strong provincial capital strategy on regional innovation efficiency and finds that the strategy significantly improves the regional innovation efficiency of provincial capital cities in the initial stage through the resource aggregation effect and policy preferences. Large firms play an important role in R&D activities by their economies of scale and diversification advantages, which reduce innovation risks and increase innovation success rates. However, as the strategy continues, the over-strengthening of provincial capitals may trigger a series of negative effects, such as resource congestion, policy crowding-out

effects, and weakening of the innovation capacity of neighboring regions, leading to an imbalance in regional development. As a result, the relationship between strong provincial capitals and innovation shows an inverted "U" shape, and the spillover effect to the surrounding areas is limited, and the marginal cities are difficult to keep up with the pace of development of the central cities due to the loss of innovation factors, which further affects the overall improvement of the province's innovation level.

Based on the above findings, this paper puts forward the following suggestions to optimize the strategy of strong provincial capitals and enhance regional innovation efficiency:

First, the government should balance the distribution of resources to avoid the negative impact of over-agglomeration, focus on the rational allocation of resources when implementing the strategy of strong provincial capitals, guide the orderly flow of innovation factors through differentiated regional development policies, safeguard the needs of innovation and development in provincial capitals while taking into account the balanced development of neighboring regions, and alleviate congestion and policy crowding out effects. At the same time, it should strengthen policy coordination and management, reduce direct market intervention, improve the efficiency of resource utilization, and stimulate the innovation vitality of enterprises. In addition, the government should also promote regional cooperation, establish innovation alliances or cooperation platforms, promote the in-depth integration of industry, academia, and research, realize collaborative innovation, accelerate the transformation of scientific and technological achievements, and enhance regional innovation capacity and competitiveness. Optimizing the innovation environment, upgrading infrastructure and public services, formulating policies to attract talents, attracting high-end talents to innovate and start businesses, and providing solid support for regional innovation. Finally, strengthening supervision and evaluation to ensure the effectiveness of policies is an important guarantee for the implementation of the strategy of strong provincial capitals. The government should establish a perfect supervision and evaluation mechanism to regularly evaluate and provide feedback on the implementation effect of the strategy of strong provincial capitals. Based on the evaluation results, it should adjust the policy direction and strength promptly to ensure that the strategy of strong provincial capitals can continue to promote the improvement of regional innovation efficiency and inject new vitality into the economic development of the province and even the whole country.

Disclosure statement

The author declares no conflict of interest.

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