

Research on the Influence of FDI on China's Economic Innovation Development

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Abstract. Foreign direct investment (FDI) and outward foreign direct investment (OFDI) are the primary methods through which capital moves internationally. They serve as significant conduits for technological spillover, which is vital for the progress of countries and regions. Through the combined impact of the growth in foreign direct investment and the two-way flow of FDI, China may enhance its access to various production resources, including labor, capital, and energy. Additionally, this enables China to improve the distribution of intangible assets such as knowledge and technology. Consequently, there is an urgent need to establish and implement a strategy that prioritizes innovation-driven development. This study utilizes China's provincial panel data from 2000-2020 to examine the relationship between the expansion of foreign direct investment (FDI) and the level of innovation. The regional innovation index is used as the dependent variable, while the FDI scale is used as the independent variable. Additionally, a model is employed to test the impact of China's FDI scale expansion on regional innovation capacity. Simultaneously, this study takes into account the disparities in development between the eastern region and the central and western regions, as well as the influence of the Pilot Free Trade Zone policy. Consequently, the sample is further categorized into the eastern region, central region, and western region for a more detailed analysis. Relevant countermeasures are provided based on the results of the empirical analysis mentioned above.

1 Introduction

Based on data from the National Bureau of Statistics, China's research and experimental development investment in 2021 amounted to 2.8 trillion yuan, marking a 14.2% increase compared to the previous year. This growth represents six consecutive years of double-digit expansion, positioning China as the world's second-largest investor in this field. Furthermore, the increase in investment intensity reached a record high in 2010. Record-breaking level reached, surpassing previous year's starting point. China's investment in research and experimental development in 2021 amounted to approximately 5.72 million full-time equivalent personnel per year. This represents 25.3% of the global total and positions China as the leading country in this regard. China's investment in innovation is among the highest globally, and its degree of innovation has made significant advancements.

However, there remains a discernible disparity between China and industrialized nations in terms of effectively translating innovation breakthroughs into practical applications [1]. Based on the data published by the World Intellectual Property Organization, China was positioned as the 12th country in the Global Innovation Index for the year 2021. Despite an improvement in its ranking, China's performance still falls short of meeting the anticipated impact of investment in innovation [2].

Hence, it is imperative that we enhance our innovation capabilities in order to rectify the issue of disproportionate input and output. China's vigorous promotion of the "Belt and Road" program and the creation of pilot free trade zones have propelled the coordinated growth of two-way foreign direct investment (FDI) in China into a new phase. The equilibrium model of two-way direct investment has now achieved stability. What will be the effect of FDI development on the innovative capacity of the region? China's formulation of policies based on scientific and rational principles, along with the promotion of innovation, holds immense practical importance in achieving high-quality economic development.

2 Theoretical analysis and research hypotheses

Over the past few years, there has been a significant influx of foreign direct investment on a huge scale, resulting in a substantial increase in capital inflows to the country [3]. This has played a crucial role in providing robust economic backing for innovation. These investments not only give financial support for research and development, production, and marketing activities of enterprises, but also foster the growth of innovative businesses [4]. Investing in research and trial costs is crucial for innovation, and FDI offers

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dependable financial backing for businesses, expediting the innovation process and propelling technological advancement. The increase in foreign direct investment has enticed international firms from various sectors to enter the local market, resulting in the transfer of technology and expertise. Foreign firms typically possess sophisticated technology and extensive management expertise, which can be transferred to local enterprises via FDI, thereby fostering the advancement of innovation [5]. Domestic firms have the opportunity to participate in technological collaboration with international enterprises, gaining insights into their cutting-edge technology and management strategies, so strengthening their own capacity for innovation and competitiveness. Simultaneously, the increase in FDI has resulted in greater market accessibility and heightened competition, thereby fostering the growth of an innovative economy. The influx of foreign firms has heightened market competition, compelling local enterprises to bolster their innovation capacities in order to endure and thrive in the market. Increasing competition compels firms to consistently innovate and offer superior products and services to attract consumers. Simultaneously, the free market offers prospects for domestic firms, enticing increased investment and collaboration, and fostering innovation. The presence of international firms has attracted highly skilled professionals and infused local enterprises with fresh inventive energy [6]. These talented individuals who work for and establish businesses in domestic firms not only introduce new ideas and methods to the company, but also enhance the pool of skilled individuals in creative organizations. Simultaneously, the existence of foreign firms has also incentivized domestic enterprises to intensify their endeavors in fostering talent, resulting in the establishment of a more favorable environment for innovation. The proliferation of foreign direct investment has had a beneficial impact on fostering the growth of creative economies. It facilitates the infusion of cash, technology, and expertise into firms, so significantly fostering innovation and encouraging market openness while intensifying competitiveness. Furthermore, it expedites the movement of skilled individuals and the cultivation of a dynamic and inventive environment. This article presents the following assumptions:

H1: Increasing the scale of FDI can generally stimulate the growth of an innovative economy.

Nevertheless, extensively advanced locations frequently allure a substantial influx of FDI, which might impact neighboring areas via the diffusion of technological knowledge [7]. Technology spillover is the spread of superior technology, management expertise, and industrial methods resulting from foreign investment, which improves overall innovation capabilities. In contrast, less developed countries may struggle to completely assimilate the innovative components introduced by foreign investment due to a dearth of sophisticated technology and managerial expertise. The growth of FDI is intricately linked to the improvement of

innovation capacity and the appeal of human resources. The presence of highly skilled individuals is essential for fostering innovation. However, in economically disadvantaged areas, the ability for talented individuals to move and be sought after may be restricted. Consequently, these places may have a limited capacity to attract FDI, resulting in a comparatively deficient ability to innovate. FDI development and innovation can be influenced by several factors such as varying levels of regional development, policy contexts, and economies of scale. Advanced regions typically possess a more extensive policy framework, encompassing measures such as tax reduction, intellectual property protection, and other factors that enhance the attractiveness for an influx of FDI [8]. Simultaneously, the presence of economies of scale in these locations enables them to efficiently offer resources and markets, thereby attracting a greater amount of FDI and fostering innovation. Consequently, regions that are highly developed are generally more capable of effectively incorporating and utilizing elements like technology spillovers, talent, and the regulatory environment resulting from FDI, thereby improving their ability to innovate. Underdeveloped regions may have constraints in adopting new technologies and lack sufficient skilled workforce, leading to reduced capacity for innovation. According to this, this article puts out the following suppositions:

H2: The influence of FDI on innovation is different depending on the level of economic development in a region and shows diversity.

3 Research Design

3.1 Variable Description

Innovative economic development is the dependent variable, calculated using the entropy method [9]. This article draws on previous research experience to construct indicators for measuring the development of innovative economies, as shown in Table

The FDI scale is the explanatory variable, expressed as the total investment of foreign-invested enterprises.

Control variables: This article draws on previous research results and selects common factors that affect the development of innovative economies as control variables [10]. Economic development (GDP), R&D investment intensity (R&D), financial market development level (finance), technology market development level (technology market), urbanization level (urbanization), regional education level (edu).

3.2 Data sources

This article uses provincial panel data from the past 20 years for analysis, and the dependent variable is

calculated using the entropy method. All other data is sourced from the National Bureau of Statistics.

Table 1. Indicator description.

| First level indicator | Second level indicator | Description | Attributes |
|-----------------------|-------------------------------|----------------------------------|------------|
| Innovation | R&D | Proportion | positive |
| | Research investment intensity | Proportion | positive |
| | Patent grants | Patent grants per million people | positive |

4 Empirical analysis

4.1. Descriptive statistics

This article conducted descriptive statistical analysis on each variable, This paper selects the provincial panel data from 2000 to 2020 for descriptive statistics, and the

variables involved include the year, foreign direct investment, innovation index, GDP, financial market development degree, and the results are shown in Table 2.

Table 2. Descriptive statistics

| VARIABLES | (1) N | (2) mean | (3) sd | (4) min | (5) max |
|-------------------|----------|-------------|-----------|------------|------------|
| code | 315 | 8 | 4.327 | 1 | 15 |
| year | 315 | 2,010 | 6.065 | 2,000 | 2,020 |
| II | 315 | 90.10 | 9.962 | 57.05 | 100 |
| FDI | 315 | 528.4 | 475.7 | 7.449 | 2,257 |
| GDP | 315 | 18,838 | 17,707 | 1,401 | 102,719 |
| Finance | 315 | 0.259 | 0.125 | 0.0663 | 0.704 |
| RD | 315 | 0.0171 | 0.0132 | 0.00227 | 0.0644 |
| edu | 315 | 0.0205 | 0.00574 | 0.00805 | 0.0425 |
| Urbanization | 315 | 0.589 | 0.134 | 0.228 | 0.896 |
| Technology market | 315 | 0.0151 | 0.0296 | 0.000322 | 0.175 |

4.2 Correlation analysis

According to Table 3, there is a positive correlation between the development level of innovative economy and FDI scale, indicating that the larger the FDI scale,

the higher the development level of innovative economy. H1 has been preliminarily verified.

Table 3. Correlation analysis.

| | II | FDI | GDP | Finance | RD | edu | Urbanization |
|--------------|----------|----------|-----------|----------|----------|----------|--------------|
| II | 1 | | | | | | |
| FDI | 0.508*** | 1 | | | | | |
| GDP | 0.524*** | 0.731*** | 1 | | | | |
| Finance | 0.113** | 0.185*** | 0.104* | 1 | | | |
| RD | 0.598*** | 0.421*** | 0.314*** | 0.288*** | 1 | | |
| edu | 0.094* | -0.098* | -0.169*** | 0.321*** | 0.434*** | 1 | |
| Urbanization | 0.0620 | 0.0380 | 0.0320 | 0.684*** | 0.383*** | 0.636*** | 1 |
| mkt | 0.361*** | 0.154*** | 0.0600 | 0.215*** | 0.857*** | 0.553*** | 0.427*** |

4.3 Regressive analysis

Table 4 shows the benchmark regression results, which show that the regression results of the FDI scale on the development level of innovative economies are significantly positive, and the regression results are significant at the 1% level, indicating that the introduction of FDI has a promoting effect on the development of innovative economies. Hypothesis 1 is valid. After adding control variables, the positivity and negativity of the regression coefficients did not change, and the difference in the size of the regression coefficients was not significant. The regression results of analyzing the control variables show that the regression coefficients for economic development level, R&D investment, urbanization level, and technology market development level are significant, while the impact of education level and financial market development level on innovative economic development is not significant, which may be related to data processing and selection. Therefore, while expanding the scale of FDI, a region or country should also focus on developing the urbanization level of the region and promoting the development of the technology market.

Table 4. Regressive analysis.

| VARIABLES | II |
|-------------------|-------------|
| FDI | 0.000 |
| | (0.19) |
| GDP | 0.000*** |
| | (5.07) |
| Finance | 1.408 |
| | (0.31) |
| RD | 599.563*** |
| | (8.31) |
| edu | 153.560 |
| | (1.50) |
| Urbanization | -13.821*** |
| | (-2.69) |
| Technology market | -105.322*** |
| | (-3.43) |
| Constant | 82.700*** |
| | (37.13) |
| Observations | 315 |
| R-squared | 0.526 |

t-statistics in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

4.4 Heterogeneity test

This article examines the potential variation in the influence of FDI on innovation, based on the level of economic development in different regions. The analysis focuses on cities located in the eastern area (A), central

region (B), and western region (C), and using group regression techniques. The regression findings are displayed in Table 5. Table 5 indicates that there is no statistically significant association between the level of innovation and the scale of FDI in the central and western areas. The magnitude of FDI in the eastern region has a substantial influence on fostering regional creativity. There is a strong positive connection at the 1% significance level, suggesting that as the FDI scale increases in the eastern region, the innovation index in that area also rises. Hypothesis 2 is confirmed

Table 5. Heterogeneity test.

| | A | B | C |
|--------------|------------|----------|----------|
| VARIABLE S | II | II | II |
| FDI | -0.000*** | 0.027 | -0.030 |
| | (-3.73) | (1.60) | (-1.09) |
| GDP | 0.000*** | 0.001*** | 0.002*** |
| | (5.45) | (3.17) | (3.62) |
| Finance | 4.214*** | 4.371 | -27.711 |
| | (4.68) | (0.04) | (-1.01) |
| R & D | -0.340*** | -3.289 | -1.102 |
| | (-4.20) | (-0.87) | (-0.58) |
| edu | -3.658** | -31.158 | -10.446 |
| | (-2.78) | (-0.88) | (-0.35) |
| mkt | -93.186** | -10.839 | 628.916 |
| | (-2.18) | (-0.02) | (1.10) |
| Urbanization | -42.238*** | 7.954 | 31.468 |
| | (-6.95) | (0.04) | (1.24) |
| Observation | 156 | 236 | 143 |

4.5 Robustness check

To further demonstrate the reliability of the conclusion, this article conducts robustness tests on the regression results by replacing variables. The explanatory variable FDI scale is represented by the total import and export volume of foreign direct investment enterprises, and the data is sourced from the National Bureau of Statistics. Regression analysis is conducted again, and the results are shown in Table 6.

From Table 6, it can be seen that after replacing the explanatory variable, the FDI scale and innovation index still show a positive correlation, further proving the validity of hypothesis 1.

Table 6. Robustness check

| VARIABLES | II |
|--------------|----------------------|
| FDI | -0.008* (-1.87) |
| GDP | 0.000*** (6.15) |
| Finance | -36.335** (-2.40) |
| R&D | -0.246 (-0.38) |
| Edu | 7.940 (1.55) |
| mkt | 584.845*** (3.04) |
| Urbanization | 21.178 (1.39) |
| Observations | 315 |
| R-squared | 0.553 |

5 Conclusion

According to the research findings mentioned above, this article offers the following recommendations:

Firstly, leveraging the high-level opening up to the global market as a chance and prioritizing the coordinated growth of two-way foreign direct investment to strengthen regional innovative capabilities. In order to achieve this objective, it is imperative for regions to proactively establish an equitable, transparent, and predictable business climate. This can be accomplished by streamlining procedures for foreign investment access, minimizing the list of restrictions on foreign investment, and eliminating any policies that hinder foreign investment access. It is imperative to exert efforts in order to encourage investment facilitation and guarantee equitable market competitiveness as means to attract foreign investment. Simultaneously, promote the expansion of firms into foreign markets and encourage their participation in foreign direct investment, so enhancing their ability to withstand risks and increase profitability in overseas ventures. Offer crucial assistance and assurance in improving regional innovation capacity.

Furthermore, the free trade zone should effectively utilize its policy advantages of experimentation and learning from mistakes, fully exploit the influential role of foreign direct investment and overseas investment by Chinese enterprises, foster the harmonious development of two-way direct investment, and attain mutual benefits and mutually advantageous outcomes. Simultaneously, it is crucial to have a precise comprehension of one's functional positioning and unique comparative advantages, taking into account various reform tasks and development objectives. Furthermore, we will actively facilitate economic integration and synchronized

development between the regions encompassing the free trade zone and the adjacent areas. We will expedite the cross-regional movement of innovative components, enhance the efficiency of resource allocation, and bolster regional innovation capabilities. Equations should be centred and should be numbered with the number on the right-hand side.

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