

Regional Foreign Direct Investment and New-Quality Productivity

-- Empirical Evidence based on Manufacturing Listed Companies

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Abstract. New-quality productivity is driven by innovation and is developed with high quality in the new era. Taking the listed companies from 2011 to 2021 as research samples, this paper discusses the influence of regional foreign direct investment (FDI) on the new quality productivity of enterprises and its internal mechanism. The empirical results show that FDI has a significant role in promoting the level of new quality productivity of enterprises. The mechanism analysis shows that FDI can improve the level of new quality productivity of enterprises by promoting the level of regional intellectual property protection. Further heterogeneity analysis shows that FDI plays a more significant role in promoting the new quality productivity level of non-state-owned enterprises, enterprises with high heterogeneity of executive team education background, and technology-intensive enterprises. The conclusion of this paper is of great significance in further attracting foreign investment and enhancing the new quality productivity of enterprises.

Keywords: FDI; New Quality Productivity; Intellectual Property Protection.

1. Introduction

In September 2023, General Secretary Xi Jinping put forward “accelerating the formation of new quality productivity” during his inspection tour in Heilongjiang Province and made it clear for the first time the importance of developing new quality productivity and cultivating emerging industries for future development. At the 11th collective study in the Political Bureau of the Communist Party of China (CPC) Central Committee in 2024, General Secretary Xi Jinping once again emphasized accelerating the development of new quality productivity and deepening the development of high quality. As an important part of the market economy, enterprises must implement the development of new quality productivity. So, how to promote enterprises to actively develop new quality productivity is an urgent problem that needs to be discussed at present.

At present, the relevant research mainly includes the definition of the concept, the factors that influence it, and the economic consequences of new quality productivity. From a macro perspective, the new quality productivity emphasizes the fundamental promotion of scientific and technological innovation to productivity. From the micro level, the new quality productivity emphasizes the promotion effect of enterprise technological innovation and management innovation on productivity (Wang Jue, 2024). However, the research on the influencing factors of new quality productivity still lacks empirical evidence.

FDI is one of the national policies that attract investment, which can cause changes in industrial structure, human capital, and system, thus promoting economic growth (Jiang Jinfan, 2004). The technology spillover effect of FDI reduces production costs and improves production efficiency, thus promoting enterprise innovation and affecting economic growth (Boone, 2000). FDI entry helps enterprises improve production efficiency and product quality by improving distribution efficiency and technical efficiency and accelerating technology transfer (Caves, 1974). Thus, will the entry of FDI affect the level of new quality productivity of enterprises? In view of the existing research gaps, this paper takes listed companies in 2011-2021 as research samples to study the influence and internal mechanism of regional foreign direct investment on the new quality productivity of enterprises in order to make up for the existing research gaps.

Compared with the existing research, the contributions of this paper are as follows: First, it enriches the relevant research on the influencing factors of new quality productivity of enterprises from an empirical point of view. The existing research mainly analyzes the factors that promote enterprises to develop new quality productivity from the perspective of the relationship between the development of the digital economy and the internal management and production of enterprises. (Duan Gang et al.,2024; Sklyar et al.,2019). As an important policy for economic development, this paper supplements and expands it from the macro perspective of FDI.

This paper explores the influence of FDI on the new quality productivity of enterprises from a macro perspective and finds that FDI promotes the development of new quality productivity of enterprises by affecting the protection of intellectual property rights. Secondly, it enriches the relevant research on the economic consequences of FDI. The existing related research mainly analyzes the influence of FDI on enterprise operating efficiency, market competition, and innovation (He Hui et al., 2022; Fu Miao, 2009; Jiang Jinfan, 2004), and this paper analyzes the possible impact of FDI from the perspective of new productivity. Thirdly, the research conclusion of this paper has important enlightenment significance for further attracting investment and promoting enterprises to develop new quality productivity.

2. Literature Review and Theoretical Analysis

2.1 Literature Review

2.1.1 Literature Related to New Quality Productivity

Theoretical research on new quality productivity mainly involves connotation, characteristics, and significance. Explaining the connotation of new quality productivity from a single dimension can be understood as labor materials (Sun Liwei and Guo Junhua, 2024). In the era of the digital economy, artificial intelligence, cloud computing, and other technologies have become new productivity (Shi Jianxun and Xu Ling, 2024). From a multi-dimensional perspective, the new quality productivity has changed significantly in terms of workers, labor materials, and labor objects (Pu Qingping and Yearning, 2024), which is a leap in productivity. The development of new quality productivity provides an action guide for the high-quality economic development of China (Pu Qingping and Huang Yuanyuan, 2023).

The research on the factors influencing new quality productivity mainly involves the government level, enterprise level, management individuals, and so on. The government has formulated a reasonable industrial development plan, promulgated corresponding policies and laws, and promoted the level of productivity (Zhou Wen and Xu Lingyun, 2023). Lei Xue (2024) found that the increase in the government's financial expenditure on science and technology and education and the improvement of the system of talents and industries can promote the balanced development of new quality productivity. In order to achieve high-level scientific and technological self-reliance in the development of new quality productivity, enterprises should strengthen cooperation with innovative countries and actively integrate into the global innovation network (Zhou Wen and Xu Lingyun, 2023). On the other hand, it is necessary to form industrial clusters and exert economies of scale (Wang Jue, 2024). A positive management tone can attract investors, ease financing constraints, and thus promote the development of new quality productivity (Yu Ting and Liu Jiaqing, 2024). Yang Fang et al. (2023) believed that restricting the power of management and restraining the opportunistic behavior of managers can improve the efficiency of resource allocation, thus accelerating the development of new quality productivity.

2.1.2 Literature Related to FDI

FDI affects the production and operation activities, such as business efficiency and innovation through the spillover effect, and improves the regional market environment. Luo Jun and Chen Jianguo (2014) believed that Chinese enterprises imitated and increased R&D investment by learning

advanced technology and management methods of foreign-funded enterprises, thus having a positive impact on enterprise innovation. Cai Hong and Jiang Ren'ai (2015) believed that regions with more foreign direct investment produced more technology spillovers, and the regional intellectual property protection system encouraged enterprises to narrow the technology gap with foreign investors so that more technology spillovers were absorbed. The influence of FDI is mainly reflected in the enterprise's operating efficiency, innovation, and regional market environment, but whether it can promote the development of new quality productivity deserves further analysis and inspection.

2.2 Theoretical Analysis

Talent flow, technology research and development, and capital supply jointly promote the new quality of productivity (Shi Jianxun and Xu Ling, 2024). FDI brings abundant capital to enterprises, making up the capital gap of enterprises, thus increasing the confidence of banks or credit institutions, easing the financing constraints of enterprises (Li Xin and Yang Jiaoping, 2021), and providing financial support for enterprises to develop new quality productivity. From the perspective of the spillover effect, FDI can play a training role through the training of local management talents and R&D talents by foreign-funded enterprises, improve the stock and quality of human capital in the host country (Guo Shizhen and Wan Xiuli, 2009), and provide human resources for enterprises to develop new quality productivity. On the other hand, the technological gap between multinational companies and enterprises in the host country makes FDI have a demonstration effect, and the host country improves its own technological level by imitating and learning new technologies, new products, and production processes (Gao Fei et al., 2014), thus providing technical support for developing new quality productivity. Therefore, FDI can promote the development of new productivity of enterprises in the above ways.

H1: FDI is conducive to promoting the development of new productivity of enterprises.

It is worth noting that the key to developing new quality productivity is research and innovation. However, R&D innovation has externalities. If intellectual property rights protection is insufficient, infringing enterprises will gain the advantage of innovation results with zero R&D cost and compete with innovative enterprises at low prices. Innovative enterprises may be at a competitive disadvantage because of a large number of R&D costs, which leads decision-makers to be unwilling to continue to invest in innovation (Pan Yue et al., 2016). Therefore, it is necessary to improve the intellectual property protection system further. Foreign direct investment requires the host country to have a perfect intellectual property protection system to protect the technology spillover effect brought by FDI, so the inflow of FDI indirectly promotes the standardization of the host country's market environment and strengthens the level of intellectual property protection (Xu Lei et al., 2021). The improvement of the level of intellectual property protection is also conducive to enterprises carrying out innovative activities and helping enterprises to develop new quality productivity (Liang Xu and Xu Lei, 2020). On the one hand, the rising level of intellectual property protection will establish advantages for multinational companies, improve the rate of return on investment, and then help improve domestic innovation capacity (Mansfield, 2000), which is helpful for the development of new quality productivity of enterprises. On the other hand, the improvement of the intensity of intellectual property protection will increase the willingness of multinational companies to transfer high-tech links, and the quality of regional innovation will also be improved (Yang Zhenzeng and Liu Jing, 2018), which will help enterprises develop new quality productivity.

Therefore, this paper puts forward the following assumptions:

H2: FDI promotes the development of new productivity of enterprises by improving the level of intellectual property protection.

3. Research Design

3.1 Data Source

This paper selects listed companies from 2011 to 2021 as research samples. The sample data is processed as follows: deleting financial companies and ST and ST* companies. In order to eliminate the influence of extreme values, the continuous variables are truncated at 1% and 99% levels. After the above processing, 6063 samples of observation data were finally obtained. The data sources include the China Stock Market & Accounting Research Database (CSMAR) and China City Database.

3.2 Variable Definition

3.2.1 Explained Variable

Table 1. Enterprise New Quality Productivity Index

Target layer	Dimension	Primary index	Secondary index	Indicator value description	Weight	Attribute
New quality productivity N_{pro}	Labor force	Living labor	Salary proportion of R&D personnel	R&D expenses-salary/operating income	28	+
			R&D personnel ratio	Number of R&D personnel/number of employees	4	+
			Proportion of highly educated people	Number of undergraduate or above/number of employees	1	+
		Materialized labour	Proportion of fixed assets	Fixed assets/total assets	2	+
			Proportion of manufacturing expenses	Subtotal of cash outflow from operating activities + depreciation of fixed assets + amortization of intangible assets + impairment reserve - cash paid for goods and services - paid to employees and wages paid for employees) / (Subtotal of cash outflow from operating activities + depreciation of fixed assets + amortization of intangible assets -impairment reserve)	1	+
	Implement of production	Hard science and technology	R&D depreciation and amortization ratio	R&D expenses -depreciation and amortization/operating income	27	+
			R&D rental fee ratio	R&D expenses -rental expenses/operating income	2	+
			Proportion of direct investment in R&D	R&D expenses-direct investment/operating income	28	+
			Proportion of intangible assets	Intangible assets/total assets	3	+
		Soft science and technology	Turnover rate of total assets	Operating income/average total assets	1	+
			Turnover rate of equity multiplier	Owner's equity/total assets	1	+

The explained variable in this paper is new quality productivity ($Npro$). Based on the theory of two elements of productivity, the new quality productivity is measured with reference to the entropy method of Song Jia et al. (2024). The specific steps are as follows:

First, selecting strategic emerging industries and future industries that have a significant relationship with new quality productivity as samples. Secondly, according to the theory of two elements of productivity, a new index system of productivity is constructed. Detailed indicators are shown in Table 1. Thirdly, the entropy method is used to calculate the weights of related indicators, thus obtaining the new quality productivity indicators. The results are shown in Table 1.

3.2.2 Explanatory Variable

The variable explained in this paper is foreign direct investment (FDI) at the provincial level. Referring to the research idea of Gu Xiaolan et al. (2020), this paper selects the level of foreign direct investment as a measurement index, that is, the proportion of actual foreign investment in GDP in each province. At present, FDI in China is denominated in US dollars, so it is calculated by converting it into RMB according to the exchange rate of the National Bureau of Statistics over the years.

3.2.3 Control Variable

After referring to the existing literature, this paper selected 12 control variables from the provincial and enterprise levels. The age (AGE) of an enterprise is measured by the logarithm of the difference between the current year and the year when the enterprise was established; The enterprise size ($Size$) is measured by the logarithm of the enterprise asset size; Asset-liability ratio (Lev) is measured by the ratio of total liabilities to total assets; Return on net assets (ROA) is measured by the proportion of enterprise net profit to total assets; Capital intensity ($Capital$) is measured by the ratio of total assets to operating income; Enterprise growth ($Growth$) is measured by the growth rate of enterprise operating income; Board size ($Board$) is measured by the logarithm of the number of board members; Proportion of independent directors ($Independ$) is measured by the proportion of independent directors to the board of directors; When the property of enterprises ($Property$) is state-owned enterprises, the value is 1, otherwise it is 0; The level of economic development ($Economic$) is measured by the logarithm of per capita GDP; The proportion of primary industry to GDP ($IND1_03$) is measured by the proportion of primary industry to GDP in each province; The ratio of the secondary industry to GDP ($IND2_03$) is measured by the ratio of the secondary industry to GDP in each province.

3.3 Research Model

In order to verify the impact of regional FDI on the new quality productivity of enterprises, this paper will use the fixed effect model to estimate and compare the regression results after controlling different fixed effects. The model is set as follows:

$$Npro_{it} = \beta_0 + \beta_1 FDI_{jt} + \sum_{i=1}^n \gamma_i X_{it} + \sigma_{it} + \theta_{it} + \delta_{it} + \mu_{it} \quad (1)$$

Among them, $Npro_{it}$ is the new quality productivity level of enterprise i in the t -th year, FDI_{jt} is the foreign direct investment level of province j in the t -th year, X_{it} is the control variable, σ_{it} is the year fixed effect, θ_{it} is the industry fixed effect, δ_{it} is the province's fixed effect, μ_{it} is a random error term.

4. Empirical Results

4.1 Benchmark Regression

In this paper, formula (1) is used to regress the panel data of manufacturing listed companies and provinces from 2011 to 2021, and the results are shown in Table 2. In Table 2, column (1) is the univariate regression result, column (2) is the regression result of adding control variables and

controlling year and industry effects, column (3) is the regression result of adding control variables and controlling year, province and industry effects, and column (4) is the regression result of adding control variables and controlling year, province and industry effects. In all the above regression results, the coefficient of *FDI* is significantly positive, and it is significant at the statistical level of 5%, indicating that regional FDI has a significant positive impact on the new quality productivity of enterprises.

Table 2. Benchmark Regression

Variable	(1) <i>Npro</i>	(2) <i>Npro</i>	(3) <i>Npro</i>	(4) <i>Npro</i>
<i>FDI</i>	0.011** (2.570)	0.006** (1.970)	0.010** (2.310)	0.010** (2.340)
<i>Size</i>		-0.000 (-1.210)	-0.000 (-1.390)	-0.000 (-0.690)
<i>Lev</i>		0.000 (1.620)	0.000 (1.340)	0.000 (1.340)
<i>ROA</i>		0.001** (2.030)	0.001** (2.090)	0.001* (1.680)
<i>Capital</i>		0.000 (1.640)	0.000* (1.810)	0.000 (1.170)
<i>Growth</i>		0.000 (0.360)	0.000 (0.110)	0.000 (0.330)
<i>Board</i>		-0.001*** (-2.640)	-0.000** (-2.110)	-0.001*** (-2.970)
<i>Independ</i>		-0.001 (-0.870)	0.000 (0.160)	-0.001 (-1.120)
<i>Property</i>		0.000 (0.230)	0.000 (0.150)	0.000 (0.180)
<i>AGE</i>		-0.000 (-1.440)	-0.000 (-1.390)	-0.000* (-1.830)
<i>Economic</i>		0.000*** (2.670)	0.000 (1.580)	0.000** (2.230)
<i>IND1_03</i>		0.002 (1.530)	-0.000 (-0.320)	0.001 (0.450)
<i>IND2_03</i>		-0.000 (-0.540)	-0.001** (-2.340)	-0.001** (-2.220)
<i>_cons</i>	0.004*** (14.960)	0.003** (2.070)	0.004** (2.230)	0.003* (1.780)
Year	Yes	Yes	Yes	Yes
Province	Yes	No	Yes	Yes
Industry	Yes	Yes	No	Yes
N	6063	5032	5032	5032
Adj R ²	0.066	0.054	0.055	0.071

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

4.2 Mechanism Analysis

The previous regression results show that FDI has significantly improved the new quality productivity level of enterprises, and then the ways in which FDI promotes the new quality productivity level of enterprises will be further analyzed.

In order to test the influence mechanism, this paper constructs the following model:

$$Npro_{it} = \alpha_0 + \alpha_1 FDI_{jt} + \alpha_2 Ln_IPP_{jt} + \alpha_3 Ln_IPP_{jt} \times FDI_{jt} + \sum_{i=1}^n \gamma_i X_{it} + \sigma_{it} + \theta_{it} + \delta_{it} + \mu_{it} \tag{2}$$

In model (2), Ln_IPP_{jt} represents the intellectual property protection level of city j in the t -th year, and the larger the value, the higher the intellectual property protection intensity of city j . Referring to the research ideas of Shen Guobing and Huang Yuejun (2019), the intensity of intellectual property protection at the city level is constructed:

$$IPP_{jt} = \frac{IPPCourt_{jt}/GDP_{jt}}{IPPCourt_{ct}/GDP_{ct}}$$

Among them, $IPPCourt_{jt}$ and GDP_{jt} represent the number of closed intellectual property trials and GDP of city j in t -th year, respectively; $IPPCourt_{ct}$ and GDP_{ct} represent the total number of closed intellectual property trials and China's GDP in the t -th year.

According to the results in column (1) of Table 3, FDI can significantly improve the protection intensity of areas with low levels of intellectual property protection. As shown in column (2) of Table 3, the coefficient of interaction term is significantly negative, indicating that if the level of regional intellectual property protection is low, FDI can promote the development of new quality productivity of enterprises by promoting regional intellectual property protection.

Table 3. Mechanism Analysis

Variable	(1) <i>Ln IPP</i>	(2) <i>Npro</i>
<i>FDI</i>	-6.705*** (-3.050)	0.003 (0.450)
<i>Ln IPP</i>		0.000 (1.240)
<i>FDI*Ln IPP</i>		-0.004* (-1.920)
<i>Controls</i>	Yes	Yes
<i>_cons</i>	-4.057*** (-5.650)	0.003 (1.530)
Year	Yes	Yes
Province	Yes	Yes
Industry	Yes	Yes
N	4878	4878
Adj R ²	0.650	0.071

4.3 Robustness Test

In order to further enhance the robustness of the conclusion and alleviate the worry about the possible endogenous problems, this paper tests the core explanatory variables and the explained variables, excluding the impact of the same period events, the explanatory variables lagging behind by one period, the tendency score matching, and the instrumental variables lagging behind by one period of FDI . The regression results are consistent with the benchmark regression results, which proves the reliability of the conclusion of the article (limited to the length of the article; the test results are for future reference).

5. Heterogeneity Analysis

5.1 Nature of the Property Right

Under the government's protection, state-owned enterprises have a weak sense of competition and risk, which leads to insufficient motivation to learn and imitate the cutting-edge knowledge and advanced technology of foreign-funded enterprises. Compared with state-owned enterprises, non-state-owned enterprises are facing a more intense market competition environment, so it is necessary to constantly seek technological innovation and product upgrading to maintain their market position.

Therefore, it is speculated that non-state-owned enterprises have a higher willingness and motivation to absorb technology spillover and innovative resources brought by *FDI*. Adding the cross-product term (*FDI * Property*) of foreign direct investment (*FDI*) and whether it is a state-owned enterprise (*Property*) to the regression model (1), it can be seen from column (1) of Table 4 that the regression coefficient of cross-product term (*FDI*Property*) and new quality productivity is -0.0162, and it is significantly negatively correlated at the level of 1%, indicating the promotion effect of FDI on new quality productivity.

5.2 Educational Background of the Senior Management Team

The high heterogeneity of the educational background of the top management team is conducive to enterprises accepting new ideas, ideas, and concepts, stimulating the vitality of the team, promoting the overall innovative consciousness and ability of the team, and adopting innovative strategies. The higher the heterogeneity of the education level of the top management team, the more likely it is for enterprises to contact and accept the new technology brought by the entry of FDI, thus contributing to the development of new quality productivity of enterprises. Adding the cross-product term (*FDI*Education*) of *FDI* and educational background heterogeneity to the regression model (1), it can be seen from column (2) of Table 4 that the regression coefficient of the cross-product term (*FDI*Education*) and new quality productivity is 0.0577, and it is significantly positive at the level of 1%. This indicates that the higher the educational background heterogeneity of the top management team, the stronger the ability of FDI to improve the new quality productivity level, which is in line with the previous hypothesis.

5.3 Industry Characteristics

Table 4. Heterogeneity Analysis

Variable	(1) <i>Npro</i>	(2) <i>Npro</i>	(3) <i>Npro</i>
<i>FDI</i>	0.016*** (3.010)	-0.016** (-2.000)	0.000 (0.040)
<i>Property</i>	0.000** (2.470)	0.000 (0.870)	0.000 (0.250)
<i>FDI*Property</i>	-0.016*** (-2.990)		
<i>Education</i>		-0.001*** (-2.980)	
<i>FDI*Education</i>		0.058*** (3.540)	
<i>TIE</i>			-0.000 (-0.270)
<i>FDI*TIE</i>			0.016*** (2.970)
<i>Controls</i>	Yes	Yes	Yes
<i>_cons</i>	0.003 (1.620)	0.004** (2.160)	0.003* (1.920)
Year	Yes	Yes	Yes
Province	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	5032	4582	5032
Adj R ²	0.072	0.076	0.072

Different factor-intensive enterprises have great differences in factor input and production technology. Technology-intensive enterprises usually have the characteristics of high R&D investment, high technology content, and strong demand for innovation, and the demand for advanced technology and management experience brought by FDI is more urgent. On the other hand, technology-intensive enterprises themselves have more technology accumulation. When FDI brings

advanced technology and experience, it is easier to absorb and transform into the internal productivity of enterprises. Adding *FDI* and whether it is a technology-intensive product (*FDI*TIE*) into the regression model (1) for regression, it can be seen from column (3) of Table 4 that the regression coefficient of the product (*FDI*TIE*) and the new quality productivity is 0.0162, and there is a significant positive correlation at the level of 1%, indicating that FDI has a stronger role in promoting the new quality productivity level of technology-intensive enterprises, which is in line with the previous hypothesis.

6. Conclusion

Taking the listed companies in 2011-2021 as the research object, this paper analyzes the influence of regional foreign direct investment on new quality productivity, studies the influence mechanism from the perspective of intellectual property protection, and draws the following main conclusions: (1) Regional foreign direct investment has a significant role in promoting the new quality productivity of enterprises, and the conclusion remains unchanged after a series of robustness tests. (2) Foreign direct investment has significantly improved the level of regional intellectual property protection, thus significantly improving the new quality productivity of enterprises. (3) Analyzing the heterogeneity from the perspective of technology absorptive capacity of enterprises, the results show that FDI plays a greater role in promoting the new quality productivity level of non-state-owned enterprises, enterprises with high heterogeneity of executive team education background, and technology-intensive enterprises. Non-state-owned enterprises can absorb and utilize the technology and management experience brought by FDI more quickly; Enterprises with high heterogeneity in the educational background of the top management team can better grasp the opportunities brought by FDI because of their broader vision and acceptance; Technology-intensive enterprises are the main body of innovation activities, and the introduction of FDI accelerates the iteration and upgrading of technology.

The conclusion of this paper is instructive for the government to introduce foreign direct investment and promote enterprises to develop new quality productivity. The government should introduce and improve policies to attract FDI, introduce high-quality foreign capital, and promote the development of new quality productivity of enterprises. It is important to increase opening up, give full play to the competitive effect of FDI, and urge regional governments to optimize the business environment. It is also necessary to strengthen the protection of regional intellectual property rights and provide a fairer and more transparent legal environment for foreign-invested enterprises.

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