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A Study on the Impact of New Quality Productivity on the High-quality Development of Manufacturing Enterprises

Yingqi Yu[1,*], Yanqiu He[2] and Yichen Zou[1]

[1]*School of Management, Department of Business Administration, Guangdong Ocean University, Zhanjiang 524000, Guangdong, China*

[2]*School of Management, Department of Accounting, Guangdong Ocean University, Zhanjiang 524000, Guangdong*

**Corresponding author: Yingqi Yu, E-mail: 11551131hh@stu.gdou.edu.cn.*

Abstract

New-quality productive forces are advanced productive forces that align with the new development philosophy; achieve rapid development through the optimal combination of factors such as labor, technology, and data; and exhibit characteristics of high technology, high quasiefficiency, and improvement in total factor productivity as their core hallmark. This paper uses 2,022 manufacturing companies listed on the Shanghai and Shenzhen stock exchanges from 2012--2023 as a sample to empirically test the impact, mechanism, and product high geneity of new quality development of manufacturing companies. The study shows that new quality productivity can significantly promote the high-quality development of manufacturing companies. Additionally, through its role in alleviating financing constraints and promoting supply chain diversification, it has a significant effect on large and private enterprises, as well as regions with high levels of income and a labor force, but has no significant effect on SMEs or regions with low labor force levels. It also has an inhibitory effect on state-owned enterprises and regions with low levels of informatization. This study provides practical reference for manufacturing enterprises to seize the development opportunities of new-quality productive forces and achieve high-quality development while also offering a scientific basis for governments to further optimize industrial policies and regional development environments.

Keywords

new quality productivity, high-quality development of manufacturing enterprises, financing constraints, supply chain diversification

1. Introduction

New quality productivity was first proposed in September 2023. In the 11th collective study of the Political Bureau of the 20th Central Committee, its core connotation was further explained: “The new productivity is the one where innovation plays a leading role, breaks away from the traditional economic growth mode and productivity development path, and has the characteristics of high technology, high efficiency, and the characteristics of high quality are in line with the qualitative state of advanced productivity of the new development concept.” In the transition direction of advanced productivity, new-quality productivity has a key promoting role in the high-quality development of manufacturing enterprises through technological innovation, factor reorganization and model reform (Han et al., 2024). It can not only accelerate the technological innovation and digital transformation of enterprises and improve production efficiency and product quality but also optimize resource allocation, reshape the industrial and supply chain systems, and enhance enterprises' ability to resist risk and market competitiveness. At the same time, new quality productivity promotes the adaptive adjustment of production relationships, gives birth to new industries and new formats, and injects a continuous impetus into the high-quality development of Chinese manufacturing enterprises, which are high-end, intelligent and green.

The development trend and main characteristics of China's manufacturing industry are a reflection of the complex and changeable development situation at home and abroad, the superposition of the achievements of China's manufacturing power building during 2012--2023, and the main focus of the future development of China's manufacturing industry. As the main force of "Made in China", the overall scale of China's manufacturing industry in 2023 has remained the highest in the world for 14 consecutive years. Among them, as the core entity of the development of this industry, the manufacturing enterprise is the main force driving the transformation from "Made in China" to "Smart Manufacturing in China", as well as a key force in building a modern industrial system and achieving high-quality development. Its development level is directly related to China's stability and competitiveness, and the development of the entire industrial chain occupies an important strategic position in the new development pattern of dual cycles at home and abroad. Therefore, it is important to study the high-quality development of manufacturing enterprises.

Although the importance of new quality productivity has been widely recognized, the existing research still has significant deficiencies in terms of the intrinsic relationship between new quality productivity and the high-quality development of manufacturing enterprises. At the theoretical level, the current research results have focused mostly on the macroeconomic growth effect and the industry scale effect, and further investigations on the microenterprise influencing mechanism are lacking (Zhao et al., 2021). In practice, manufacturing enterprises generally face many challenges. Many enterprises have made slow progress in the application of new technologies. Only a few head enterprises have achieved significant results in the integration and application of cutting-edge technologies. Some SMEs face a lack of technical talent or capital. In contrast, some state-owned enterprises are constrained by institutional inertia and find it difficult to integrate new productivity factors into the production process (Tang & Wang, 2025).

To compensate for the existing deficiencies, this paper investigated the effect, mechanism and heterogeneity of new productivity on the high-quality development of manufacturing enterprises and focused on answering the following questions. First, we explore whether new productivity affects the high quality of manufacturing enterprises. Second, are there internal influencing mechanisms such as financing constraints and supply chain diversification? Third, do the influencing effects vary at the firm level due to differences in firm size or the nature of property rights at the regional level, whether due to the level of informatization or differences according to the level of the labor force?

This paper is highly important at both the theoretical and practical levels. At the theoretical level, first, the paper enriches the theoretical system for the high-quality development of manufacturing enterprises and reveals the intrinsic reason that new productivity affects the development of enterprises through mechanisms such as financing constraints and supply chain diversification. Second, the existing research results focus mostly on the conclusions of industries such as agriculture and tourism and further expand the theoretical analysis framework of the action of new-quality productivity on micromanufacturing enterprises. Third, this paper uses a more comprehensive perspective. Measurement analysis further enriches the microscopic arguments of the existing research on manufacturing enterprises and makes up for the possible inadequacy of the existing research results when they focus on the macroscopic perspective of the manufacturing industry (Tang & Wang, 2025). From a practical level, first, this paper provides a scientific basis for manufacturing enterprises to grasp opportunities for new productivity and optimize strategic decision-making, as well as a guiding direction for the government to formulate regional innovation policies and optimize the industrial environment to help China's manufacturing industry achieve high-quality development. Second, this paper provides a scientific basis for manufacturing enterprises to ease financing constraints and rely on the supply chain to synergize the release of new productivity effects, as well as a decision-making reference for the government to formulate regional policies, such as focusing on the optimization of the financing environment for manufacturing enterprises and the establishment of collaborative innovation platforms for supply chains. This helps China's manufacturing enterprises achieve high-quality development driven by new-quality productivity.

2. Theoretical Analysis and Research Hypotheses

2.1 New Quality Productivity and High-quality Development of Manufacturing Enterprises

New quality productivity is closely related to the high-quality development of manufacturing enterprises. The transition direction of advanced productivity has a significant and direct promoting effect on the high-quality development of manufacturing enterprises (Chao & Wang, 2024). The formation and development of new quality productivity stem from revolutionary breakthroughs in technology, the innovative allocation of production factors and the in-depth restructuring and upgrading of industries. These changes have brought new development opportunities and driving mechanisms to manufacturing enterprises (Li & Yu, 2024).

From the perspective of technology application, new productivity reconstructs the qualitative state of manufacturing productivity through the revolutionary breakthrough of the technology system. The penetration of new technology groups such as digital technology, artificial intelligence, and the industrial internet has promoted the transition of the manufacturing production paradigm from large scale to flexible. Zhu and Li (2024) showed that an intelligent sensing system and digital twin technology equipped with new quality productivity can improve production efficiency and reduce the product defective rate in the manufacturing industry, directly causing the enterprise's cost curve to shift down and quality standards to move up. Shi et al. (2025) noted that the technology penetration of new productivity forces enables manufacturing enterprises to respond to individual needs with modular production, forming a new production paradigm of "mass customization" in the automotive and electronics industries. Reforms increase total factor productivity. Under the framework of high-quality development, the application of new technologies has gradually formed a virtuous circle of technology iteration and industrial upgrading in manufacturing enterprises.

From the perspective of industrial change, new productivity urges the manufacturing industry to continuously carry out technological innovation, restructuring and upgrading, which results in corresponding changes in product architecture, business models, application scenarios, etc., thus promoting industrial upgrading and reform. Zhu and Li (2024) noted that new productivity promotes the transformation of the manufacturing production paradigm toward intelligence and greenness, which changes the allocation of production factors through technological innovation and improves total factor productivity. In terms of product architecture, the manufacturing industry is transforming from a single product to a modular and integrated product. For example, the automobile industry is upgrading to intelligent and networked vehicles, which have incorporated technologies in multiple fields, such as communication and artificial intelligence. In terms of business models, service-oriented transformation has become a trend, with companies transforming from pure product manufacturers to comprehensive solution providers. For example, industrial internet platform companies provide customized services to customers on the basis of data analysis (Shi et al., 2025). This series of changes has promoted the evolution of the industrial chain from linear to mesh ecology and further promoted the manufacturing industry in the high-quality development direction of high-end, smart, and green.

From the perspective of production relations, productivity determines production relations (Han et al., 2024). The emergence of new productivity forces has caused revolutionary changes in production relations. The innovative combination of production factors reflected in new productivity has driven the transformation of the manufacturing industry into a more intelligent and sustainable development model. The research of Han et al. (2024) shows that the integration of new production factors such as data and artificial intelligence has promoted the transformation of the manufacturing industry from a traditional capital–labor binary structure to a "data–technology–capital–labor" pluralistic synergy model, and the organizational form of enterprises has been affected. Additionally, the transition from a bureaucratic system to a flat and networked system has occurred. The new business forms spawned by new productivity have not only changed the division of labor and cooperation within enterprises but also prompted upstream and downstream enterprises in the industrial chain to form closer collaborative innovation alliances (Shi et al., 2025). Under this change in production relations, the resource allocation efficiency of manufacturing enterprises has been significantly improved, and the demand for workers' skills has been transformed into a highly intellectual and complex one, promoting the transformation of the manufacturing industry into a more sustainable development model and providing a guarantee for the high-quality development of manufacturing enterprises.

From the perspective of stakeholders, new quality productivity can also increase with ESG-oriented sustainable development goals through green technology innovation and increased total factor productivity (Zhou & Qi, 2024). This model not only helps enterprises maximize economic benefits but also performs well in terms of environmental and social responsibility, thereby winning the support and recognition of a wider range of stakeholders and thereby enhancing investor confidence and customer loyalty (Zhang et al., 2025). In addition, Wang et al. (2022) noted that new productivity promotes an increase in total factor productivity through green technology innovation, which is in line with the goal of sustainable development. Against the background of the “dual-carbon” strategy, manufacturing enterprises can rely on new energy technologies to reduce the carbon emission intensity per unit of output value and optimize the monitoring of industrial resource consumption through digital twin technology (Li & Zhao, 2024). This technology-driven development model not only breaks through the dual constraints of resources and energy consumption of the traditional growth path but also reconstructs the creation logic of the manufacturing value chain through the synergy of green process innovation and an increase in total factor productivity.

On the basis of the above theoretical mechanism, this paper first proposes the following hypothesis:

H1: New-quality productivity significantly promotes the high-quality development of manufacturing enterprises.

2.2 New Quality Productivity, Financing Constraint Level and High-quality Development of Manufacturing Enterprises

Financing constraints refer to the degree of limitation that an enterprise faces in obtaining funds in the financial market (Weisbach et al., 2004). This limitation stems from factors such as information asymmetry, credit risk assessment and an imperfect capital market, which significantly affect enterprises' funding acquisition and development potential. As the core kinetic energy driving economic development, new quality productivity is closely related to and interacts with the level of financing constraints. It improves the operating efficiency and credit status of enterprises and relieves financing constraints through technological innovation and factor restructuring; at the same time, it uses data opening to optimize information transfer between the bank and the enterprise and lowers the financing threshold. The dynamic interaction of the two promotes enterprises to break through the funding bottleneck and accelerates technological innovation and resource optimization, becoming a key force for manufacturing enterprises to achieve high-quality development.

From the perspective of credit risk, financing constraints have a threshold effect on the impact of the financialization of real enterprises on high-quality development, and new productivity can enhance the comprehensive strength and competitiveness of manufacturing enterprises, thereby enhancing their financing ability in the financial market. New quality productivity can accelerate the digital transformation of enterprises, enhance the agglomeration of the regional labor force and improve the business environment. Through digital transformation, enterprises can optimize production processes, improve production efficiency, thereby improving product quality and market share, and obtain more stable cash flow and profits (Shi et al., 2025). This good operating condition reduces the credit risk of the enterprise in the eyes of financial institutions, and the financial institutions are more willing to provide financing support, thus further easing the enterprise's financing constraints (Lin et al., 2022).

In terms of information transfer and credit evaluation, new quality productivity helps reduce the information asymmetry between manufacturing enterprises and financial institutions. Under the role of new productivity, public data opening can relieve information friction from the external level so that the production, operational, and financial data of enterprises can be recorded and transmitted in a timelier and more accurate manner. Financial institutions can rely on this rich data to be more comprehensive, accurately assess the credit status and development potential of an enterprise, further reduce the financing threshold caused by information asymmetry, and create favorable conditions for enterprise financing (Hu, 2025).

In terms of resource allocation and efficiency improvement, Gong and Hu (2013) noted that resource allocation efficiency has an important effect on total factor productivity (TFP) and that new productivity can optimize the resource allocation of manufacturing enterprises and improve the utilization efficiency of resources. Through the introduction of new technologies, new elements and new industries, new quality productivity promotes the technological innovation and management innovation of enterprises, thereby improving their production efficiency and economic benefits. This optimization of resource allocation not only improves the production efficiency of the enterprise but also enhances the market competitiveness of the enterprise, increasing its advantage in the process of high-quality development. Ye and Wang (2025) noted that by optimizing resource allocation, enterprises can be better able to make timely adjustments and upgrades in response to market changes, thereby further improving their resource use efficiency and achieving sustainable growth in the process of high-quality development.

In summary, new quality productivity improves the level of corporate financing constraints by reducing credit risk, improving information transmission, and optimizing resource allocation, forming a virtuous circle of “enhancement of new quality productivity—improving the level of financing constraints—promoting high-quality development”. This provides theoretical support and practical direction for manufacturing companies to break through the funding bottleneck and achieve sustainable growth and highlights the core value of new productivity in breaking financing constraints and driving high-quality development.

Therefore, this paper proposes the following hypothesis:

H2: New quality productivity promotes the high-quality development of manufacturing enterprises by alleviating financing constraints.

2.3 New Quality Productivity, Supply Chain Diversification and High-quality Development of Manufacturing Enterprises

Supply chain diversification refers to the enhancement of the stability and flexibility of the supply chain by increasing the number of suppliers, optimizing the supplier structure, and expanding the supply chain network, thereby enhancing the enterprise’s ability to resist risk and market competitiveness. This diversification strategy not only helps companies address market fluctuations and uncertainties but also promotes the effective allocation of resources and collaborative innovation.

From the perspective of risk diversification, new-quality productivity has built a solid technical foundation and source of motivation for supply chain diversification. Hu (2025) noted that improvements in new-quality productivity drive the technological innovation, restructuring and upgrading of manufacturing enterprises. This enables enterprises to rely on digital technology to build efficient and transparent supply chain networks, accurately identify high-quality suppliers through big data analysis, and with the help of the Internet of Things (IoT). Real-time monitoring of the entire supply chain process. This type of technology empowerment motivates companies to reduce their dependence on a single supplier and build a diversified supplier system. When a supplier has risks such as supply interruption, the enterprise can quickly switch to other suppliers, which can effectively disperse risks, maintain production stability and continuity, and provide a solid guarantee for high-quality development.

From the perspective of resource allocation, supply chain diversification has become the core path of enterprise resource optimization. Shi et al. (2025) show that by cooperating with different types of suppliers, enterprises can obtain a wider range of resources and technical support. Driven by new quality productivity, enterprises can be based on market demand and their own development strategy to integrate high-quality raw materials, advanced production technology and innovative concepts from diversified suppliers to achieve the scientific allocation of resources. This type of allocation optimization not only improves production efficiency but also stimulates the vitality of enterprise innovation, promotes product upgrading and production model reform, and helps enterprises transform toward high-quality development.

From the perspective of collaborative innovation, new quality productivity is reshaping the collaborative ecology between enterprises and suppliers. Feng and Dang (2025) suggested that the process of new quality productivity to promote the transformation of manufacturing industry to a smart and sustainable model, enterprises rely on big data, the Internet of Things and other technologies to establish a close partnership with suppliers to achieve high-frequency interaction and deep sharing of information. On this basis, enterprises and suppliers carry out collaborative innovation centering on technology research and development, product design and other links to overcome technical problems jointly and accelerate the transformation of technological achievements. This type of collaborative innovation not only enhances the core competitiveness of an enterprise but also drives the technology upgrading and optimization of the entire supply chain, forming a virtuous circle of "enterprise development—supply chain upgrading—enterprise redevelopment" and continuously promoting the high-quality development of the manufacturing industry.

In summary, supply chain diversification is an irreplaceable link between the new-quality productivity and high-quality development of manufacturing enterprises. New-quality productivity provides technology support and a transformative driving force for supply chain diversification, while supply chain diversification has become a key engine for enterprises to achieve high-quality development through risk diversification, resource allocation optimization and collaborative innovation. Manufacturing enterprises should fully grasp the opportunities for the development of new productivity forces, continue to expand the strategy of supply chain diversification, release the development potential, and further achieve the goal of high-quality development.

Therefore, this paper proposes the following hypothesis:

H3: New-quality productivity promotes the high-quality development of manufacturing enterprises by promoting the diversification of the supply chain.

3. Research Design

3.1 Sample Selection and Data Sources

This paper selects the 2012--2023 Shanghai and Shenzhen A-share manufacturing companies in China as the research objects. All data involved in this study were obtained from the Guotai An (CSMAR) database. To ensure the accuracy of the research results, the data were processed as follows: (1) the 1% and 99% quantiles were used to reduce the tails for the continuous variables to reduce the interference of outliers; (2) the STs with abnormal financial status were excluded. (3) Samples with incomplete data records were excluded. A sample of 2022 listed manufacturing companies involving 16 provinces from 2012--2023 is obtained, forming 13163 enterprise-year observation samples. In addition, Stata17 software was used to analyze the empirical results.

3.2 Definition and Description of Variables

3.2.1 Explained Variable: High-quality Development of Manufacturing Enterprises

Lu and Lian (2012) divided various econometric methods into frontier and nonfrontier methods, as shown in Table 1. Referring to the study by Shi et al. (2025), this paper selects total factor productivity as a proxy variable for the high-quality development of enterprises.

Table 1: Classification of total factor productivity estimation methods

	Deterministic method	**Metering method**	
		Parameter method	**Semi-parametric method**
Frontier Analysis	DEA (Data Envelopment Analysis) FDH method	Stochastic Frontier Analysis (Macro-Micro)	—
Non-cutting-edge Analysis	Growth Accounting method (Macro)	Growth Rate Regression method (Macro)	Proxy Variable method (Micro)

Source: Del Gatto et al. (2011), Figure 1.

Currently, the methods used in academia to measure total factor productivity include the OP method, the LP method, and the SFA method, among which the LP method and OP method are representative of parametric methods and have been widely recognized in academia (Li, 2022). (1) OP method: The OP method was proposed by Olley and Pakes (1996) and uses the enterprise's current investment as a proxy variable to solve the endogeneity problem (2) LP method: Levinsohn and Petrin (2003) propose using the intermediate input m to construct the proxy variable relationship $m_{it} = f(k_{it}, \omega_{it})$ and solving the endogeneity problem by inferring ω_{it} through nonparametric estimation.

The OP method can effectively avoid the bias that occurs in the sample selection process. Therefore, in the present study, with reference to the study by Huang et al. (2019), the OP method is used to calculate total factor productivity.

3.2.2 Explanatory variables

New quality productivity (NQP): With reference to the study of Wang and Wang (2024), the entropy method was used to construct a provincial-level evaluation index system of the new quality productivity development level from the three dimensions of laborers, labor objects, and means of production (see Table 2).

Table 2: Indicator system of new quality productivity

Target Layer	**Criterion Layer**	**First-level Index**	**Second-level Index**	**Third-level Index**	**Measurement Method**	**Attribute**
New Productive Forces	Laborers	Laborers' Skills	Educational Level	Average Educational Level per Capita	Average Years of Education per Capita	+
			Human Capital Structure	Human Capital Structure of Laborers	The educational attainment of the labor force is classified into 5 levels, measured by vector angle	+
				Structure of College and University Students	Proportion of College Students in Total Population	+
		Labor Productivity	Output per Capita	GDP per Capita	GDP/Total Population	+
			Income per Capita	Wage per Capita	Average Wage of On-the-job Employees	+
		Laborers' Awareness	Employment Concept	Proportion of Employees in Tertiary Industry	Proportion of Tertiary Industry Employees in Total Employment	+
			Entrepreneurship Concept	Entrepreneurial Activity	Entrepreneurial Activity	+
	Objects of Labor	New-quality Industries	Strategic Emerging Industries	Proportion of Emerging Strategic Industries	Added Value of Emerging Strategic Industries/GDP	+
			Future Industries	Number of Robots	Number of Robots/Total Population	+
		Ecological Environment	Green Environmental Protection	Forest Coverage Rate	Forest Coverage Rate	+
				Environmental Protection Efforts	Environmental Protection Expenditure/Government Public Fiscal Expenditure	+
			Pollution Reduction	Pollutant Emissions	Sulfur Dioxide Emissions/GDP Wastewater Discharge/GDP General Industrial Solid Waste Generation/GDP	–
				Industrial Waste Treatment	Industrial Wastewater Treatment Facilities (Sets)	+

Target Layer	Criterion Layer	First-level Index	Second-level Index	Third-level Index	Measurement Method	Attribute
					Industrial Waste Gas Treatment Facilities (Sets) Industrial Solid Waste	
	Means of Production	Material Means of Production	Infrastructure	Traditional Infrastructure	Highway Mileage Railway Mileage	+
				Digital Infrastructure	Optical Fiber Length Number of Internet Broadband Access Ports per Capita	+
			Energy Consumption	Total Energy Consumption	Energy Consumption/GDP	_
				Renewable Energy Consumption	Renewable Energy Power Consumption/Total Social Electricity Consumption	+
		Intangible Means of Production	Scientific and Technological Innovation	Number of Patents per Capita	Number of Patent Authorizations/Total Population	+
				R&D Investment	R&D Expenditure/GDP	+
			Digitalization Level	Digital Economy	Digital Economy Index	+
				Enterprise Digitalization	Level of Enterprise Digitalization	+

3.2.3 Mechanism Variables: Financing Constraint Index, Supply Chain Diversification

(1) Level Of Financing Constraints

Hadlock and Pierce (2010) were the first to propose the concept of the financing constraint level. The financing constraint index reflects the relative financing constraint level of a group of sample companies. The representative measurement methods include the KZ index (Lamont et al., 2001), FC index (Lamont et al., 2001), and WW index (Whited & Wu, 2006) and the SA index (Hadlock & Pierce, 2010). This paper uses the SA index to measure the degree of financing constraint, mainly on the basis of its exogeneity and stability advantages. The SA index depends only on the two exogenous variables of firm age and size, which avoids the endogenous bias caused by the inclusion of endogenous financial indicators (such as cash flow and the leverage ratio) in the KZ, FC, and WW indices and is more suitable for analyzing the productivity of new industries. Impact on the high-quality development of enterprises. In addition, the SA index is more sensitive to SMEs and young innovative enterprises, so it can more accurately reflect the degree of financing constraints of manufacturing enterprises and is easy to calculate, making it suitable for large-sample empirical research and enhancing the reliability and comparability of research results.

The performance of the corporate financing constraint index is measured by the SA index published in the Guotai'an database. The calculation of the SA index was based on the study by Ju et al. (2013). The specific calculation method is as follows:

$$SA = -0.737 \times Size + 0.043 \times Size^2 - 0.04 \times Age$$

where Size is the enterprise size and Age is the age of the enterprise.

(2) Diversification of the Supply Chain

Supply chain diversification can better reflect the high-quality development level of enterprises. Therefore, with reference to the studies of Xie et al. (2025) and Wu and Yao (2023), supply chain concentration is represented by the average of the ratio of sales from the top five customers to total sales for the year and the ratio of purchases from the top five suppliers to total purchases for the year, and then the degree of supply chain diversification is measured by subtracting supply chain concentration from one.

3.2.4 Control Variables

To reduce the bias in the results, the following control variables are selected in the present study: the level of high-quality development of the enterprise. The explanatory variables include the proportion of independent directors (IndepRatio), the age of the firm (FirmAge), the level of enterprise investment (CapExRatio), the profitability of the enterprise (ROE), the R&D expenditure (RDSumRatio), and whether it is a Big Four accounting firm (Big4). Table 1 lists the definitions of the variables used in this study.

Table 3: Definitions of variables

Variable Type	**Variable Name**	**Variable Symbol**	**Measurement Method**
Dependent Variable	Enterprise Total Factor Productivity	TFP_OP	Estimation of TFP using the OP method
		TFP_LP	Estimation of TFP using the LP method
Independent Variable	Regional New Productive Forces	NQP	Estimated by the entropy method based on the evaluation index system for the development level of new productive forces
Mechanism Variable	Financing Constraint Index	SA	Modified SA Index
	Supply Chain Diversification	conc	1-the common logarithm of enterprise supply chain concentration
Control Variable	Proportion of Independent Directors	IndepRatio	Number of Independent Directors / Total Number of Board Members
	Firm Age	FirmAge	Years since Listing
	Enterprise Investment Level	CapExRatio	Capital Expenditure / R&D Expenditure
	Enterprise Profitability	ROE	Net Profit / Balance of Shareholders' Equity
	R&D Expenditure	RDSumRatio	Total R&D Expenditure of the Enterprise
	Whether it is one of the Big Four Accounting Firms	Big4	1 for Big Four firms, 0 otherwise

3.3 Model Settings

On the basis of the theoretical analysis and research assumptions above, this study constructs the following econometric model to verify the mechanism by which new productivity affects the high-quality development of manufacturing enterprises through multiple paths.

Model 1: Hypothesis H1, the direct impact of new-quality productivity on the high-quality development of manufacturing enterprises, is tested.

$$TFP\_OP_{i,t} = \alpha_0 + \alpha_1 NQP_{i,t} + \alpha_2 controls_{i,t} + \delta_{Year} + \eta_{Firm} + \varepsilon_{i,t} \quad (1)$$

Models 2 to 3: To test Hypotheses H2 and H3, new quality productivity affects the high-quality development of manufacturing enterprises through two action paths.

$$KZ_{i,t} = \alpha_0 + \alpha_1 NQP_{i,t} + \alpha_2 controls_{i,t} + \delta_{Year} + \eta_{Firm} + \varepsilon_{i,t} \quad (2)$$

$$conc_{i,t} = \alpha_0 + \alpha_1 NQP_{i,t} + \alpha_2 controls_{i,t} + \delta_{Year} + \eta_{Firm} + \varepsilon_{i,t} \quad (3)$$

where i and t represent the enterprise and the year, TFP_OP represents the total factor productivity of the enterprise, NQP represents the new quality productivity, SA represents the financing constraint index, conc represents the diversification of the supply chain, controls represent the control variable, and δ_{Year} represents the fixed effect of the year.η_{Firm} represents individual fixed effects, and ε represents a random disturbance term.

4. Empirical Analysis

4.1 Descriptive Analysis

Table 4 presents the descriptive statistics of the major variables. Specifically, the mean value of TFP_OP is 6.641, and the median is 6.562. This numerical range is basically consistent with the existing research results; the standard deviation is 0.691, indicating that there is a significant difference in TFP_OP among different manufacturing enterprises. The mean value of NQP was 0.194, the median was 0.172, and the maximum and minimum values were 0.411 and 0.083, respectively. The conclusions were consistent with those of previous studies. These slight differences may be due to the different selection ranges of the samples.

From the perspective of data validation, the descriptive statistics results of the remaining control variables were highly consistent with the conclusions of previous studies, which strongly supported the scientific nature of the data sources and the validity of the research samples for this study.

Table 4: Descriptive statistics for major variables

VARIABLES	N	Min	Mean	p50	Max	SD
TFP OP	13163	5.545	6.641	6.562	8.093	0.691
NQP	13163	0.083	0.194	0.172	0.411	0.088
IndepRatio	13163	0.300	0.382	0.364	0.500	0.058
FirmAge	13163	10.170	18.680	18.420	28.580	5.089
CapExRatio	13163	0.007	0.054	0.043	0.151	0.040
ROE	13163	-0.081	0.080	0.076	0.228	0.074
RDSumRatio	13163	0.700	4.940	4.150	13.340	3.182
Big4	13163	0.000	0.055	0.000	1.000	0.229

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, and * represents significance at the 10% level.

4.2 Correlation Analysis

To carry out regression analysis, a correlation test was performed in advance to preliminarily explore the correlation between variables. The results of the test are shown in Table 5 below. The correlation coefficient between new quality productivity (NQP) and the high-quality development of manufacturing enterprises (TFP_OP) was 0.115, which passed the statistical test at the 1% significance level. This fully validated that new quality productivity (NQP) can significantly promote the high-quality development of manufacturing enterprises (preliminary validation). Hypothesis 1 was established.

Table 5: Pearson correlation coefficient matrix

VARIABLES	TFP OP	NQP	IndepR~o	FirmAge	CapExR~o	ROE	RDSumR~o	Big4
TFP OP	1							
NQP	0.115***	1						
IndepRatio	-0.047***	0.077***	1					
FirmAge	0.193***	0.258***	-0.026***	1				
CapExRatio	-0.104***	0.046***	0.032***	-0.125***	1			
ROE	0.295***	0.017*	-0.00100	-0.027***	0.152***	1		
RDSumRatio	-0.305***	0.185***	0.031***	-0.054***	0.024***	-0.070***	1	
Big4	0.259***	0.00600	0.0140	0.051***	-0.016*	0.085***	-0.024***	1

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, and * represents significance at the 10% level.

4.3 Benchmark Regression Tests

Table 6 Model 1 included only core explanatory variables and did not include control variables. The new quality productivity has a significant positive effect on the total factor productivity of manufacturing enterprises (the regression coefficient is 0.206, which is significant at the 1% level). The control variables were further included in Model 2. The results revealed that the significance and direction of the core variables did not change (the regression coefficient was 0.342, which was significant at the 1% level). This shows that new quality productivity can increase the total factor productivity of manufacturing enterprises by 34.2%. It can be concluded that new quality productivity effectively promotes the high-quality development of manufacturing enterprises and provides new kinetic energy for the high-quality development of manufacturing enterprises. The research results verify Hypothesis 1.

Table 6: Results of the benchmark regression test

VARIABLES	(1)	(2)
	TFP_OP	TFP_OP
NQP	0.206***	0.342***
	(2.58)	(4.79)

VARIABLES	(1)	(2)
	TFP_OP	TFP_OP
IndepRatio		-0.179***
		(-3.53)
FirmAge		-0.009**
		(-2.49)
CapExRatio		-0.098
		(-1.28)
ROE		1.582***
		(38.65)
RDSumRatio		-0.048***
		(-28.02)
Big4		0.121***
		(5.64)
Constant	6.216***	6.473***
	(471.56)	(116.17)
Observations	13,163	13,163
R-squared	0.396	0.523
Number of Stkcd	2,022	2,022
Adj. R2	0.435	0.435

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

4.4 Endogeneity Test

4.4.1 Instrumental Variables Approach

The instrumental variable test method uses instrumental variables to solve the problem of endogeneity in the regression testing process to weaken the potential interference of endogeneity on the conclusions. Given that the variables that affect the high-quality development of the manufacturing industry are complex and varied, there may still be omitted variables other than the existing control variables. Therefore, this study introduces two groups of instrumental variables for validation (Ye & Wang, 2025).

(1) Regional R&D intensity (RD_GDP)

To identify the causal effect of NQP on the high-quality development of manufacturing enterprises accurately, this study uses regional R&D intensity (RD_GDP) as the instrumental variable of NQP. Regional R&D intensity is mainly determined by long-term policy orientation, resource endowment and industrial structure and is not directly related to short-term operating mechanisms (such as production processes) for the high-quality development of manufacturing enterprises; thus, R&D intensity has exogenous characteristics and is suitable as an instrumental variable (Ministry of Industry and Information Technology et al., 2025).

The regression results are shown in Tables 7. The first-stage regression shows that the coefficient of the instrumental variable RD_GDP is significantly positive (the regression coefficient is 2.599, significant at the 1% level), indicating that new-quality productivity has a stable role in promoting the high-quality development of manufacturing enterprises.

Table 7: Test results of the instrumental variables of regional R&D intensity

VARIABLES	(1)	(2)
	NQP	TFP_OP
RD_GDP	2.599***	
	(54.862)	
NQP		1.922***
		(9.961)
IndepRatio	0.054***	-0.640***
	(6.426)	(-7.153)

VARIABLES	(1)	(2)
	NQP	TFP_OP
FirmAge	0.000	0.009***
	(0.234)	(8.051)
CapExRatio	0.129***	-2.265***
	(10.314)	(-16.947)
ROE	0.003	2.526***
	(0.437)	(35.468)
RDSumRatio	0.000***	-0.070***
	(3.066)	(-40.948)
Big4	-0.018***	0.660***
	(-8.201)	(29.020)
Constant	0.017***	6.499***
	(3.956)	(136.594)
Observations	12,871	12,871
R-squared	0.609	0.279
Adj. R2	0.608	0.279

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

(2) City's Annual Median New Quality Productivity (NQPcity)

This paper chooses the annual median value of the new quality productivity of cities (NQPcity) to effectively reflect the basic level of regional new quality productivity. Theoretically, the annual median productivity of a city is determined mainly by the differences in the agglomeration of regional innovation factors, digital infrastructure construction, and the institutional environment and is not directly related to the allocation of individual resources for the high-quality development of microenterprises; thus, it has exogenous characteristics and is in line with the exclusivity constraint on the instrumental variables and is suitable as an instrumental variable in the endogeneity test.

As shown in Table 8 show that, with the increase in the annual median productivity of the city, the level of the individual new quality productivity of the enterprise significantly increases (the regression coefficient is 1.149, which is significant at the 1% level). After fitted new quality productivity was introduced into the high-quality development (TFP) model, the coefficient remained significantly positive, indicating that new quality productivity has significant robustness in promoting the high-quality development of manufacturing enterprises.

Tables 8: Test results of the instrumental variable city's annual new quality productivity median

VARIABLES	(1)	(2)
	NQP	TFP_OP
NQPcity	1.149***	
	(19.56)	
IndepRatio	0.001	-0.164**
	(0.10)	(-2.46)
FirmAge	-0.006***	0.012**
	(-5.05)	(2.31)
CapExRatio	0.004	-0.079
	(0.28)	(-0.68)
ROE	-0.022**	1.680***
	(-2.36)	(21.94)
RDSumRatio	0.000	-0.048***
	(0.30)	(-12.57)
Big4	-0.004	0.141***
	(-0.71)	(3.06)
fitted_var		3.730***
		(13.13)
Constant	0.062***	5.794***

VARIABLES	(1)	(2)
	NQP	TFP_OP
	(5.69)	(102.17)
Observations	12,627	12,627
R-squared	0.758	0.522
Year FE	YES	YES
Firm RE	YES	YES
Adj. R2	0.521	0.521

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

4.4.2 Propensity Score Matching (PSM) Method

First, the whole sample is divided into a high-variation group (experimental group) and a low-variation group (control group) on the basis of the median new productivity. Next, a logit model is constructed to estimate the propensity score of a firm entering the high-variation group. The explanatory variables here are set to the high-quality development level of the enterprise. The explanatory variables include the proportion of independent directors, the life cycle of the enterprise (i.e., the age of the enterprise), the level of investment, the profitability of the enterprise, the R&D expenditures, and whether it is a member of the Big Four accounting firm. The samples were matched via nonreplacement nearest neighbor matching, and balanced panel data of the observed values were obtained after matching.

The regression results of the matched samples are shown in Tables 9. In the first stage, the estimation coefficient of NQP was 0.165, which was significant at the 10% level; after the gradual introduction of control variables in the second stage, the estimation coefficient of NQP was 0.322, which was significant at the 1% level. This finding shows that the positive promoting effect of new productivity on the high-quality development of manufacturing enterprises is still stable after effectively controlling for the interference of sample selection bias and omitted variables, which further validates the rationality of the research hypothesis.

Table 9: Results of the Propensity Score Matching Test

VARIABLES	(1)	(2)
	TFP_OP	TFP_OP
NQP	0.165*	0.322***
	(1.86)	(4.07)
IndepRatio		-0.172***
		(-3.06)
FirmAge		-0.007*
		(-1.69)
CapExRatio		-0.094
		(-1.12)
ROE		1.596***
		(34.86)
RDSumRatio		-0.048***
		(-25.73)
Big4		0.112***
		(4.58)
Constant	6.216***	6.435***
	(414.96)	(104.56)
Observations	10,662	10,662
R-squared	0.887	0.912
Adj. R2	0.891	0.891

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

4.5 Stability Test

4.5.1 Model Adjusted for Region Fixed Effects

First, we increase the region fixed effect. The results of Model (1) in Tables 10 show that, after the provincial fixed effects are included, new productivity can still significantly improve the high-quality development level of manufacturing enterprises (the regression coefficient is 0.391, which is significant at the 1% level), indicating that after disturbances such as provincial resource endowment and the policy environment are removed, the promoting effect of new productivity on the high-quality development of manufacturing enterprises remains stable.

4.5.2 Adjusting the Sample Year to Alleviate the Policy Shock

Second, we adjust the sample year to mitigate the policy shock. In the 2022 government work report, it was clearly proposed to “start the industrial base reengineering project”, “accelerate the development of advanced manufacturing clusters” and “implement the national strategic emerging industry cluster project” and focus on supporting “specialized, special and new” enterprises in terms of funds and talent. A multilevel industrial policy-intensive promotion pattern has been formed. To identify the independent effect of the “Specialized, Special and New” policy and rule out the confounding effects of other major policies during the same period, the present study conducted another empirical test by excluding the observation sample in the year of the policy shock in 2022. The results of Model (2) in Tables 10 show that, after excluding the superposition effect of industrial policies in 2022, new productivity can still significantly promote the high-quality development of manufacturing enterprises (the regression coefficient is 0.393, which is significant at the 5% level).

4.5.3 Exclude municipalities directly under the Central Government

Third, the municipalities directly under the Central Government were excluded. Considering that the municipalities directly under the Central Government in China have significant agglomeration advantages in terms of policy resources, financial capital, and talent reserves, which may amplify the impact of new productivity on the high-quality development of manufacturing enterprises, to verify whether the core conclusions are affected by cities with special administrative levels, all observation samples of the municipalities directly under the Central Government were excluded, and other variables and model settings were kept unchanged. The result of Model (3) in Tables 10 was also significantly positive (the regression coefficient was 0.369, and it was significant at the 5% level). This finding indicates that even when the sample of municipalities with high resource concentration is excluded, new-quality productivity has an important effect on the high-quality development of manufacturing enterprises. The promoting effect still exists stably, and the core conclusions are not affected by the characteristics of the special administrative region.

Table 10: Results of the stability test

VARIABLES	**(1)**	**(2)**	**(3)**
	TFP_OP	**TFP_OP**	**TFP_OP**
NQP	0.391***	0.393**	0.369**
	(2.60)	(2.49)	(2.40)
IndepRatio	-0.175***	-0.231***	-0.139*
	(-2.73)	(-3.34)	(-1.95)
FirmAge	-0.010	-0.014	-0.012
	(-1.27)	(-1.63)	(-1.44)
CapExRatio	-0.105	-0.153	-0.047
	(-0.92)	(-1.25)	(-0.38)
ROE	1.581***	1.492***	1.538***
	(21.06)	(18.19)	(19.10)
RDSumRatio	-0.048***	-0.047***	-0.044***
	(-13.04)	(-12.14)	(-10.95)
Big4	0.123***	0.110**	0.142***
	(2.74)	(2.30)	(2.63)
Constant	6.505***	6.571***	6.448***

	(26.24)	(55.16)	(54.88)
Observations	13,163	11,278	11,275
R-squared	0.526	0.506	0.517
Adj. R2	0.525	0.506	0.516

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

4.6 Test of the Influence Mechanism

The regression results of the influence of new-quality productivity on the high-quality development of manufacturing enterprises are shown in Tables 11. Model 1 shows that the regression coefficient of NQP on financing constraints (SAs) is 5.495, and it is significant at the 1% level. Model 2 shows that NQP has a significant effect on the level of supply chain diversification (conc). The regression coefficient is 0.459, and it is significant at the 1% level, indicating that the financing constraints of manufacturing enterprises and the diversification level of the supply chain play a mechanistic role in promoting the effect of new productivity on the high-quality development of manufacturing enterprises. Therefore, research Hypotheses H2 and H3 are established.

Table 11: Inspection results of the influencing mechanisms

VARIABLES	**(1)**	**(2)**
	SA	**conc**
NQP	-0.273***	0.459***
	(-8.22)	(3.68)
IndepRatio	0.006	-0.261***
	(0.41)	(-3.49)
FirmAge	-0.036***	-0.026***
	(-46.61)	(-7.46)
CapExRatio	0.185***	0.358**
	(6.72)	(2.55)
ROEB	0.010	-0.121*
	(0.67)	(-1.66)
RDSumRatio	-0.000	0.008**
	(-0.24)	(2.03)
Big4	0.026**	0.023
	(2.24)	(0.46)
Constant	-3.114***	-1.839***
	(-264.86)	(-32.14)
Observations	13,163	13,039
R-squared	0.854	0.036
Adj. R2	0.0356	0.0356

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

4.7 Heterogeneity Analysis

4.7.1 At the Enterprise Level

(1) Enterprise Scale

Differences in enterprise size have a key influence on the high-quality development of the manufacturing industry. Differences in overall organizational capabilities or resource allocation among enterprises of different sizes may affect their ability to respond to new-quality productivity (NQP). Therefore, based on the median natural logarithm of total assets disclosed in the financial reports of listed manufacturing companies, the sample is divided into large-scale enterprises and small-scale enterprises. The empirical results (Tables 12) show that, in Column (1) of the large-scale manufacturing enterprise group, the regression coefficient of regional NQP is 0.417 and is significant at the 5% level; in Column (2), the coefficient of the small-scale enterprise group is not significantly positive (0.250).

The results (Tables 12) show that, compared with small-scale manufacturing enterprises, large-scale manufacturing enterprises can rely on their more mature resource management capabilities and organization management capabilities to more significantly promote the positive effect of new productivity on the high-quality development of manufacturing enterprises (Shi et al., 2025). Specifically, large manufacturing enterprises usually have a more complete R&D system, more efficient supply chain management and more stable capital flow, enabling them to more effectively absorb and transform the technological innovation outcomes brought about by the new qualities of productivity. For example, in the process of digital transformation, large-scale enterprises can pass large-scale investments in the construction of intelligent production lines and rely on their mature internal training mechanisms to rapidly increase the skills of their employees, thereby more efficiently optimizing production processes and upgrading product quality (Wu & Yao, 2023). In addition, large enterprises often have stronger market bargaining power and risk resistance ability and can occupy the first-mover advantage in industrial transformation driven by new productivity, further consolidating their high-quality development trend. In contrast, although a flat organizational structure may offset the high costs and low efficiency brought about by the hierarchical management system to a certain extent, enterprises cannot have the multiplier effect of scale, and as a result, the high-quality development of enterprises is limited. Capital stock and financing constraints make it difficult for manufacturing enterprises to bear the costs of restructuring and upgrading in the process of high-quality development (Ye & Wang, 2025). This difference essentially reflects the difference in the organizational management capabilities and capital deployment capabilities of companies of different sizes.

(2) Nature of Enterprise Property Rights

Owing to the different natures of property rights, manufacturing enterprises may have significant differences in terms of resource acquisition channels and operational decision-making mechanisms. These differences affect the effect of new productivity on the high-quality development of enterprises. Therefore, this paper uses enterprises with state-owned or nonstate-owned attributes as property rights as the basis for dividing property heterogeneity. Tables 12 Column (3) shows that the regression coefficient of new-quality productivity on the high-quality development of state-owned manufacturing enterprises has a nonsignificant negative value (-0.066), indicating that new-quality productivity does not have a statistically significant promoting effect on the high-quality development of state-owned enterprises or even shows a weak inhibition trend. Column (4) shows that the regression coefficient of new productivity among nonstate-owned manufacturing enterprises is significantly positive (0.387, significance level is 5%), indicating that at the 5% significance level, for every 1-unit increase in qualitative productivity, the high-quality development level of nonstate-owned enterprises significantly increases by 0.387 units, and this promoting effect has statistical reliability.

As shown in Table 12, the promotion effect of new-quality productivity on the high-quality development of nonstate-owned manufacturing enterprises is significantly stronger than that of state-owned enterprises. This difference is caused by two main factors. On the one hand, Hu (2025) noted that, for a long time, state-owned enterprises have benefited from preferential policies and the advantages of administrative resource allocation and have formed a relatively fixed development model and path-dependent status by relying on institutional resources such as policy credits and franchise licensing. There is a certain conflict between the changes in the production factor combination brought about by the new quality productivity model and the traditional development model, causing state-owned enterprises to lag in adjustment when adapting to the new development model. This is consistent with the weak inhibition characteristics reflected by the insignificant negative coefficient in Column (3). Nonstate-owned enterprises have long faced credit discrimination and barriers to resource acquisition. The factor flow and new methods of resource allocation brought about by new productivity have created opportunities for them to overcome the bottleneck of development and significantly reduce the cost of high-quality development. The strong facilitating effect is reflected by the significantly positive regression coefficients in Column (4). On the other hand, when the speed of technological change exceeds the ability of institutional adjustment, efficiency loss will occur (Acemoglu et al., 2005). The operation decision-making of state-owned manufacturing enterprises is constrained by institutional inertia, the internal resource allocation process is complex, the equipment update cycle is long, and the ability to respond to development needs caused by new qualities of productivity is weak, resulting in nonsignificant results, as shown in Column (3). The problem of “difficult and expensive financing" faced by nonstate-owned enterprises is that they are forced to accelerate technology absorption and transformation, adjust the input of production factors more flexibly, quickly integrate the core elements of new productivity into the production system, and fully play the role of new productivity in high-tech enterprises. The promoting effect of quality development is confirmed by the positive coefficient at the 5% significance level in Column (4) (Li & Guo, 2024).

Table 12: Results of the heterogeneity test at the firm level

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**
	TFP_OP	**TFP_OP**	**TFP_OP**	**TFP_OP**
NQP	0.417*	0.250	-0.066	0.387**
	(1.96)	(1.23)	(-0.18)	(2.30)
IndepRatio	-0.039	-0.247***	-0.096	-0.133*
	(-0.44)	(-3.01)	(-0.79)	(-1.83)
FirmAge	0.002	0.001	0.005	-0.012
	(0.17)	(0.06)	(0.31)	(-1.56)
CapExRatio	-0.132	-0.028	0.438	-0.149
	(-0.76)	(-0.22)	(1.21)	(-1.29)
ROE	1.433***	1.535***	1.304***	1.612***
	(14.38)	(16.78)	(7.59)	(20.67)
RDSumRatio	-0.045***	-0.044***	-0.053***	-0.046***
	(-8.15)	(-9.88)	(-4.83)	(-12.01)
Big4	0.023	-0.004	-0.021	0.195***
	(0.55)	(-0.09)	(-0.24)	(3.74)
Constant	6.685***	6.056***	6.767***	6.361***
	(44.52)	(44.83)	(27.28)	(56.48)
Observations	6,584	6,579	2,633	10,530
R-squared	0.499	0.472	0.477	0.536
Adj. R2	0.535	0.535	0.535	0.535

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

4.7.2 At the Regional Level

(1) Level of Informatization

There is regional heterogeneity in the impact of new productivity on the high-quality development of the manufacturing industry, and significant differences in the informatization level (measured by the total amount of postal and telecommunications services/gross regional product) in different regions directly affect the speed of information acquisition and resource allocation by enterprise efficiency, which may lead to different effects of new mass productivity. In this study, the logarithmic median grouping method was used to divide the samples into two groups on the basis of the data at the informatization level. The results show that in areas with high levels of informatization (Tables 13 Column (1)), the regression coefficient of new productivity on the high-quality development of manufacturing enterprises is 0.936, and it is significant at the 1% level; in areas with low levels of informatization (Tables 13 Column (1)), (2)), this regression coefficient is not significantly negative (-0.339). This finding indicates that new-quality productivity can significantly promote the high-quality development of manufacturing enterprises in areas with high levels of informatization, but it is difficult to play a positive role in areas with low levels of informatization.

This difference is because, in areas with high levels of informatization, the ratio of the total amount of postal and telecommunication services to the GDP is greater, which means that the communication infrastructure and information transmission efficiency are more complete. (e.g., high-speed network communication, big data transmission, etc.) Quickly acquire information such as market demand and technological developments to integrate new productivity elements into production and operation more efficiently (Yang & Xie, 2021). For example, as a digitization highland, Shenzhen's electronic information manufacturing industry, which relies on advantages such as 5G base station density and data center computing power, has a penetration rate of new productivity factors such as the industrial internet platform reaching 68%, which is significantly higher than the national average. On the other hand, in areas with low informatization levels, which are limited by the insufficient scale of post and telecommunications services and information circulation barriers, informatization allocation efficiency is low. For example, a series of conditions, such as data transmission delays and high communication costs, may prevent enterprises from obtaining information. The poor timeliness of information further makes it difficult to integrate the advanced elements of new productivity with the local manufacturing industry, and the information lag may even increase the cost of decision-making, thus inhibiting the high-quality development of enterprises. For example, in some resource-based industrial cities in the central and western regions, because the density of optical cable lines is less than 1/3 in the eastern region, the equipment manufacturing industry frequently suffers from data transmission delays when the introduction of smart sensing systems is introduced, which limits the application effect of new quality productivity. The results in the nonsignificant negative direction were consistent with the results.

(2) Labor Force Level

Labor is the most active productivity factor (Zhu & Li, 2024). There are significant differences in the labor force level between different regions, which affects the production operation and resource utilization of enterprises. In addition, the effect of new productivity on the high-quality development of manufacturing enterprises can be differentiated. Therefore, the median value of the regional labor force level data is used in the present study. The samples were divided into two groups via the numerical grouping method. The regression results showed that in areas with high labor force levels (Tables 13 Column (3)), the regression coefficient of new-quality productivity on the high-quality development of manufacturing enterprises was 0.440, which was significant at the 10% level. In areas with low labor force levels (Tables 13 Column (4)), this regression coefficient was not significantly positive (0.354). This shows that, compared with areas with low labor force levels, new-quality productivity in areas with high labor force levels has a more obvious promoting effect on the high-quality development of manufacturing enterprises.

This difference may be due to the following two reasons. On the one hand, areas with high labor force levels tend to have more skilled and experienced labor resources, and laborers are able to break through the constraints of time and space and create more value (Zhu & Li, 2024). These labor forces can operate production equipment and execute production processes more efficiently so that advanced production factors and technologies resulting from new productivity can be applied to actual production faster and more effectively, thus better supporting the new productivity of the enterprise. play a role in further promoting the high-quality development of enterprises. Taking the Yangtze River Delta as an example, in the high-end equipment manufacturing industry, skilled workers with a professional title of technician or above account for 23%, and they can quickly master new productivity tools such as industrial robot programming and digital twin modeling, which is related to Column (3) and significantly promotes effect matching. On the other hand, in areas with low labor force levels, owing to the relative lack of skills and experience of the labor force, the application of new productivity will face more difficulties, making it difficult to give full play to the effectiveness of new productivity, resulting in the promotion of high-quality development of enterprises by new productivity. The effect was not significant. For example, in some central and western regions where traditional manufacturing industries are concentrated, skilled laborers in the textile and general machinery processing industries account for less than 8%. When automated production lines are unskilled, the equipment utilization rate is only 65%, and it is difficult to release new qualities. Productivity performance, which was consistent with the insignificant result in Column (4).

Table 13: Results of the heterogeneity test at the regional level

VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**
	TFP_OP	**TFP_OP**	**TFP_OP**	**TFP_OP**
NQP	0.936***	-0.339	0.440*	0.354
	(4.62)	(-1.44)	(1.74)	(1.52)
IndepRatio	-0.158**	-0.131	-0.164*	-0.243***
	(-2.03)	(-1.33)	(-1.87)	(-2.64)
FirmAge	0.002	-0.022*	-0.009	-0.007
	(0.18)	(-1.91)	(-1.01)	(-0.58)
CapExRatio	-0.128	-0.141	-0.132	-0.112

VARIABLES	(1)	(2)	(3)	(4)
	TFP_OP	TFP_OP	TFP_OP	TFP_OP
	(-0.82)	(-0.90)	(-0.95)	(-0.58)
ROE	1.290***	1.878***	1.522***	1.646***
	(13.61)	(16.72)	(15.50)	(14.28)
RDSumRatio	-0.050***	-0.049***	-0.047***	-0.051***
	(-9.62)	(-9.16)	(-9.42)	(-9.70)
Big4	0.096*	0.206***	0.107*	0.130**
	(1.81)	(2.69)	(1.73)	(2.05)
Constant	6.241***	6.745***	6.432***	6.527***
	(41.71)	(40.36)	(46.60)	(38.59)
Observations	7,040	6,123	7,541	5,622
R-squared	0.511	0.534	0.514	0.527
Adj. R2	0.526	0.526	0.526	0.526

Note: *** represents significance at the 1% level, ** represents significance at the 5% level, * represents significance at the 10% level, and the t values are in parentheses.

5. Conclusion and Analysis

5.1 Conclusions

This paper selects 2022 manufacturing enterprises in Shanghai and Shenzhen A-shares from 2012--2023 as a sample and investigates the effects, mechanisms and heterogeneity of new productivity on the high-quality development of manufacturing enterprises. The results revealed the following:

The conclusion that new productivity significantly promotes the high-quality development of manufacturing enterprises still holds true after the stability test; new productivity promotes the high-quality development of enterprises mainly by relieving the financing constraints of enterprises and promoting the diversification of the supply chain. Heterogeneity tests reveal that new-quality productivity has the most significant effect on the high-quality development of large enterprises and private enterprises and plays a significant role in areas with high levels of informatization and high labor force levels while affecting SMEs and low labor force levels. The effect of region is not significant, but it has an inhibitory effect on state-owned enterprises and areas with low levels of informatization.

5.2 Suggestions

1. Encouraging the application of new quality productivity by large-scale manufacturing enterprises

For large-scale manufacturing enterprises, the government should continue to provide policy support to encourage them to increase investment in new quality productivity areas. Enterprises should be encouraged to carry out technological innovation and management innovation through tax incentives, fiscal subsidies and other measures to enhance their core competitiveness. At the same time, the government should guide large-scale enterprises to cooperate with SMEs and, through industrial alliances and technology sharing, help SMEs enhance the level of new quality productivity and achieve the coordinated development of the industrial chain.

2. Promotion of the development of new-quality productivity among nonstate-owned manufacturing enterprises

For nonstate-owned manufacturing enterprises, the government should further optimize the business environment and provide more policy support and resource guarantees. Through tax preferences, fiscal subsidies and other measures, nonstate-owned enterprises are encouraged to increase investment in new productivity areas to increase their market competitiveness. Moreover, the government should strengthen services and guidance for nonstate-owned enterprises to help them solve the difficulties and problems encountered in the development process and promote the high-quality development of these enterprises.

3. The application of the new quality productivity of manufacturing enterprises in areas with high levels of informatization should be strengthened

For areas with high levels of informatization, the government should further increase its support for the application of the new productivity of manufacturing enterprises. By providing tax incentives, fiscal subsidies and other policies, enterprises are encouraged to increase investment in new quality productivity-related areas. Moreover, the government should promote the upgrading and optimization of relevant infrastructure to ensure that enterprises can make full use of advanced information technology to improve production efficiency. In addition, the government can establish a resource sharing platform to provide technical training and consulting services to help manufacturing enterprises better apply new productivities and further promote high-quality development.

4. Improving the new-quality productivity level of manufacturing enterprises in areas with high labor force levels

In areas with high labor force levels, the government should focus on supporting manufacturing enterprises to increase the level of new-quality productivity. Through the formulation of relevant policies, enterprises are encouraged to increase the training and introduction of technical personnel to improve the quality of the labor force (Qin, 2023). Moreover, the government can provide special subsidies to support enterprises in carrying out technical training and enhance the high-quality development level of enterprises. In addition, the government can promote cooperation among enterprises, universities, and scientific research institutions; promote the combination of industry, university, and research institutions; and accelerate the further promotion and application of new productivity in manufacturing enterprises, thus laying a solid foundation for the high-quality development of manufacturing enterprises.

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Conflicts of Interest

The authors declare no conflict of interest.

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