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The Coupling Coordination and Interaction Mechanism of New Quality Productivity Development and Manufacturing Transformation and Upgrading

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Abstract

Cultivating new quality productivity in the manufacturing industry is an important focus in the construction of modernized industrial system, and the development of new quality productivity in the manufacturing industry should fundamentally clarify its spatial differences and interaction mechanisms, so as to promote the high-quality development of the manufacturing industry[1]. Based on China's provincial panel data from 2011 to 2022, this paper analyzes the level of coupling and coordination between new quality productivity and manufacturing development and its spatial and temporal characteristics using the coupling coordination degree model; and examines the interaction mechanism between the two using the linkage equation. The study finds that: (1) During the sample period, the coupling and coordination degree of new quality productivity and manufacturing development generally shows a growing trend, and spatially, the coupling and coordination level of the eastern region enters the high-quality coordination zone earlier than other regions. (2) There is a significant mutual promotion effect between the new quality productivity and the transformation and upgrading of the manufacturing industry. (3) Heterogeneity test results show that the driving effect of the development of new quality productivity is stronger than the role of manufacturing transformation and upgrading on the development of new quality productivity, and compared with the low level of development of the region, the development of new quality productivity in the high level of development of the region of the manufacturing industry transformation and upgrading of the role of the promotion of the stronger[2].

Keywords

New quality productivity; manufacturing transformation and upgrading; coupled coordination; interaction mechanisms

1. Introduction

In January 2024, the "Implementation Opinions of the Central Committee of the Communist Party of China and the State Council on Promoting the Innovative Development of Future Industries" mentioned to grasp the opportunity of the new round of scientific and technological revolution and industrial change, and accelerate the development of future industries around the main battlefield of the manufacturing industry. With the rapid development and application of information technology, artificial intelligence, big data and other emerging technologies, the new quality productivity has gradually become an important driving force to promote the transformation and upgrading of the manufacturing industry[3]. Manufacturing is the pillar industry of China's national economy. With the demand for economic structural transformation and industrial upgrading, the manufacturing industry is facing the transformation from

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traditional manufacturing to intelligent manufacturing and green manufacturing[2]. The formation and development of new quality productivity will have a significant impact on the structure and layout of the manufacturing industry.

2. Current Status of Domestic and International Research

The concept of new quality productivity has received a great deal of attention from domestic scholars. Zhu Fuxian[4]and others conducted the construction of new quality productivity indexes based on the projection seeking model and concluded that new quality productivity has a close relationship with the region. Song Jia[5]and others based on regression modeling concluded that ESG development has a significant role in promoting the level of new quality productivity of enterprises. As for the transformation and upgrading of manufacturing industry, Han Gang[6]and others study the impact of green finance on its transformation and upgrading from the perspective of spatial spillover, and find that green finance has a facilitating effect on the transformation of manufacturing industry. Chen Tingqiang[7]and others studied the driving effect of energy consumption and financial support on its green innovation. Fang Yuan[8], on the other hand, studied the impact of heterogeneous environmental regulation on its green transformation based on the spatial Dubin model.

Taken together, theoretical studies on the development of new quality productivity have been relatively abundant in the existing literature, but little attention has been paid to the impact of manufacturing transformation and upgrading on the development of new quality productivity and the systematic interactions between the two, which are of great significance. On the other hand, from an empirical point of view, the neglect of endogeneity issues may cause inaccurate estimation results. Besides, a comprehensive consideration of the interaction between the development of new quality productivity and the transformation and upgrading of the manufacturing industry is also conducive to providing support for the formulation of better economic policies for the development of new quality productivity in the manufacturing industry.

3. Research Methodology and Data Sources

3.1. Model selection and data description

3.1.1. Coupling coordination degree model

The coupling coordination degree model can be calculated by calculating the coupling coordination level of new quality productivity and manufacturing development to portray the relationship between the two linkage and mutual promotion, integration and complementarity, the calculation formula is as follows:

$$D = \sqrt{C \times T}$$

$$C = 2\sqrt{(PD \times MT)(PD + MT)^2}$$

$$T = aPD + bMT$$

D is the coupling coordination degree of new quality productivity development level and manufacturing transformation and upgrading index. c is the coupling degree of the two, and t is the comprehensive reconciliation index of the two. pd is the development level of new quality productivity, and mt is the index of manufacturing transformation and upgrading. a and b are the coefficients to be determined, and the size of the value depends on the relative importance of the new quality productivity and the transformation and upgrading of the manufacturing industry, which are taken in this paper. Drawing on the existing literature on the division of coupled coordination types, the coupled coordination types can be divided into 10 categories, as shown in Table 1 below.

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Table 1. Classification of coupling coordination types

D-value interval	Coordination level	Degree
[0.0~0.1)	1	Extreme Dissonance
[0.1~0.2)	2	Severe Dissonance
[0.2~0.3)	3	Moderate Dissonance
[0.3~0.4)	4	Mildly disoriented
[0.4~0.5)	5	To be dysfunctional
[0.5~0.6)	6	Barely coordinated
[0.6~0.7)	7	Elementary coordination
[0.7~0.8)	8	Intermediate Coordination
[0.8~0.9)	9	Good Coordination
[0.9~1.0]	10	Quality coordination

3.1.2. Conjunctive modeling

The single-measurement model cannot accurately reflect the two-way influence of regional new quality productivity and manufacturing development, which will cause the endogeneity problem caused by the associativity bias. In order to solve this problem, this paper adopts the three-stage least squares (3SLS) method of the linkage model for empirical research with reference to the studies of Chuanyang Wang[9]and Jiahui Liu[10], etc. The model is set as follows:

(1) Research hypothesis

H1: There is a mutually reinforcing interaction between the development of new quality productivity and the transformation and upgrading of the manufacturing industry, i.e., the improvement of the level of new quality productivity development will promote the transformation and upgrading of the manufacturing industry, and the transformation and upgrading of the manufacturing industry will[2], in turn, improve the development of new quality productivity.

H2: The interaction between the development of new quality productivity and the transformation and upgrading of the manufacturing industry may show some differences depending on the location and region.

(2) Variable selection

Referring to the studies of Zhu Fuxian[4], Wang Jue[11], Liu Jing[12], Zhu Yajun[13] and others on the influencing factors of the development of new quality productivity and the transformation and upgrading of the manufacturing industry[14], this paper chooses the following variables, and the variable descriptions and descriptive statistics are shown in Table 2 and Table 3:

Table 2. Description of variables

Variable type		Variable
core variable		Development level of new quality productivity
		Manufacturing transformation and upgrading index
control variable	Equation 1:New quality productivity Development Equation	Level of Higher Education
		Research and Development
		Innovation Capacity
	Equation 2:Manufacturing development equation	Innovation Level
		Information Level
		Green Level
		Efficiency

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Table 3. Descriptive statistics

Variable	Abridge	Mean	Min	Max
Development level of new quality productivity	productivity	0.1683	0.0250	0.7515
Manufacturing transformation and upgrading index	education	2776	1082	5613
Level of Higher Education	research	3967688	57760	3220000
Research and Development	patent	72819	502	872209
Innovation Capacity	manufacture	0.1279	0.0417	0.5424
Innovation Level	creativity	30476	87	572589
Information Level	information	1297	46	15025
Green Level	green	0.2001	0.0073	0.8163
Efficiency	efficiency	0.0109	0.0025	0.0380

(3) Model construction:

$$productivity_{it} = \alpha_0 + \alpha_1 \ln education_{it} + \alpha_2 \ln research_{it} + \alpha_3 \ln patent_{it} + \alpha_4 manufacture_{it} + \varepsilon_{it}$$

$$manufacture_{it} = \beta_0 + \beta_1 \ln creativity_{it} + \beta_2 \ln information_{it} + \beta_3 green_{it} + \beta_4 efficiency_{it} + \beta_5 productivity_{it} + \tau_{it}$$

Among them, α_0, β_0 are constant terms. α_1, α_2, α_3, α_4, β_1, β_2, β_3, β_4, β_5 are the coefficients of the corresponding variables. ε_{it}, τ_{it} are the stochastic perturbation term of the equation.

3.2. Sample selection and data description

Considering the representativeness and availability of sample data, this paper chooses the regional data of 30 provinces (except Hong Kong, Macao, Taiwan and Tibet) in China from 2011 to 2022 as the final sample. The data of each indicator comes from the provincial and municipal data of the EPS system platform, and the missing part of the data of Internet broadband access users, the number of effective invention patents in industries above large scale, and the total amount of industrial sulfur dioxide emissions are obtained through the China Statistical Yearbook from 2011 to 2023.

4. The New Quality Productivity Development and Manufacturing Transformation and Upgrading of the Coupling Coordination Analysis

4.1. New quality productivity development and manufacturing transformation and upgrading indicator system construction

Drawing on the selection of indicators in existing literature and as long as the content of new quality productivity and high-quality development of the manufacturing industry[2], this paper constructs the second-level indicators of the development level of new quality productivity and the corresponding third-level indicators from the three dimensions of new quality laborers, new quality labor objects and new quality means of production. From the level of innovation, information level, green level and efficiency level of four dimensions to build manufacturing

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transformation and upgrading index of the second level of evaluation indicators, the weight calculation results are shown in Table 4 .

Table 4. Comprehensive evaluation system for the level of development of new quality productivity

Indicator layer	Indicator	Weight
Laborer	Government's expenditure on science and technology	0.0845
	Government's annual financial expenditure on education	0.0291
	R&D Personnel	0.0727
	Number of persons educated	0.0058
	GDP per capita	0.0172
	Average wage of employed persons	0.0114
	Share of tertiary industry	0.0030
Target Audience	Green Coverage of Built-up Area	0.0006
	Green space per capita	0.0034
	Harmless treatment capacity	0.0507
	Sanitation Vehicle Equipment	0.0387
	Harmless treatment plant for domestic garbage	0.0307
	Completed investment in industrial pollution treatment	0.0621
	Comprehensive utilization of industrial solid waste	0.0420
	Total sulfur dioxide emissions/GDP	0.1059
	Urban sewage treatment capacity	0.0463
Means of Production	Length of real roads at the end of the year	0.0470
	Road area per capita	0.0078
	Length of long-distance fiber optic cable lines	0.0286
	Internet broadband access ports	0.0466
	Number of Internet broadband access users	0.0491
	Number of authorized patent applications	0.1186
	R&D investment	0.0982
Innovation Level	R&D Expenditures as a Percentage of Expenditures	0.0937
	R&D Personnel	0.1443
	Percentage of Sales Revenue of New Products	0.0353
	Number of effective invention patents	0.2177
Information Level	Total Telecom Business	0.1312
	Number of Internet Broadband Access Ports	0.0638
	Length of long-distance fiber optic cable lines	0.0392
Green Level	Electricity consumption per unit of industrial output	0.0619
	Sulfur dioxide emission per unit of industrial output	0.1326
	Coal consumption per unit of industrial output value	0.0545
Efficiency	Labor productivity	0.0147
	Profitability of main business	0.0111
	Share of industrial added value in GDP	0.0937

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4.2. Measurement of the development level of new quality productivity and manufacturing transformation and upgrading

After calculate the weights of each index in this paper, the development level of new quality productivity and the index of manufacturing transformation and upgrading in each region are obtained by using the formula, as shown in Figure 1.

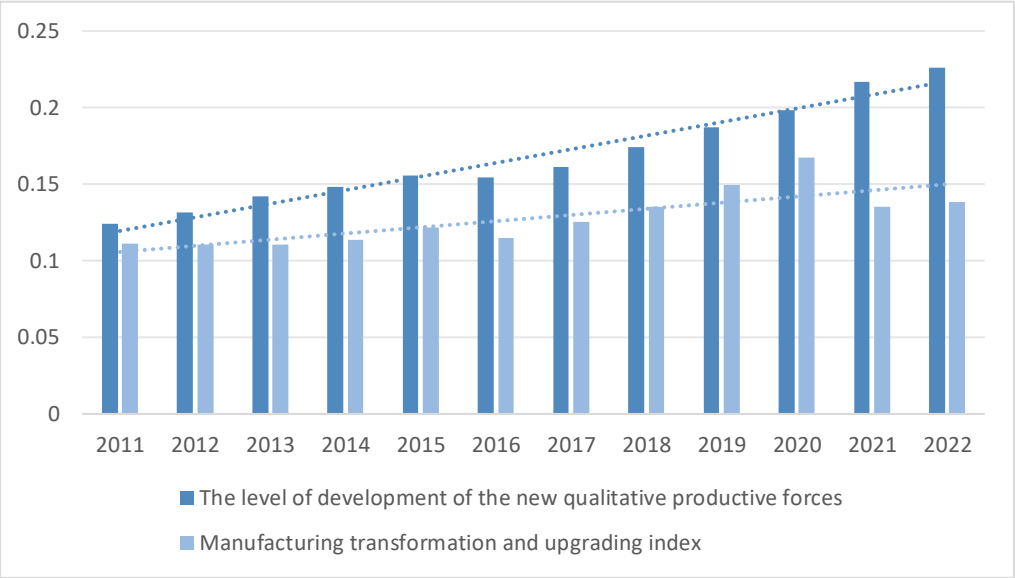

Figure 1. Trends in new quality productivity and average manufacturing development, 2011-2022

From the figure, it can be seen that from 2011 to 2022, China's new quality productivity development level nuclear manufacturing transformation and upgrading index both show a growing trend. The development level of new quality productivity increased from 0.12 in 2011 to 0.22 in 2022; the index of transformation and upgrading of the manufacturing industry increased from 0.11 in 2011 to 0.14 in 2022, and it can be clearly seen from the figure that the growth of the index of transformation and upgrading of the manufacturing industry is slower than the growth rate of the development level of new quality productivity and the index of transformation and upgrading of the manufacturing industry in 2021 by a significant decline.

4.3. Analysis of the coupling coordination between new quality productivity and manufacturing transformation and upgrading

This paper calculates the coupling coordination degree of 30 provinces and cities in China in each year according to the above coupling coordination degree model, and takes the average value of each year to represent the coupling coordination level of the year, and the specific results are shown in Table 5.

Table 5. Level of coupling and coordination of new quality productivity and manufacturing development in 30 provinces of China, 2011-2022

Year	C Value	T Value	D Value	Level
2011	0.917	0.017	0.123	2
2012	0.621	0.046	0.17	2
2013	0.534	0.098	0.229	3
2014	0.824	0.152	0.354	4
2015	0.98	0.26	0.505	6
2016	0.824	0.192	0.398	4

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2017	0.989	0.316	0.559	6
2018	0.998	0.464	0.681	7
2019	0.998	0.651	0.806	9
2020	0.988	0.857	0.92	10
2021	0.94	0.673	0.795	8
2022	0.941	0.739	0.834	9

The results in the table show that the coupling coordination degree of China's new quality productivity and manufacturing development shows an overall growth trend, from 0.123 in 2011 to 0.834 in 2022.From the perspective of the coordination interval, the average coupling coordination level of the whole year is less than 0.5 in 2011-2014, which is in the dysfunction interval, and the coupling coordination value of the year 2015 -2016 the value of coupling coordination decreased, from 2017 the coupling coordination level of China's new quality productivity and manufacturing development are greater than 0.68, in the coordination interval.

Sub-regionally, the east and the center entered the barely coordinated interval from 2015, and entered the well coordinated interval in 2019, while the coupled coordination level of the west and the northeast showed a downward trend year by year, probably due to the fact that the western and northeastern regions were originally backward in terms of economic development, and although in recent years, the economic development has been improved under the national macro-controls, the industrial base and the technical level required for the manufacturing industry are still at a backward level , so it shows the phenomenon of uncoordinated development of the two, the specific results are shown in Table 6.

Table 6.Average annual coupling harmonization levels by region

Year	All	East	Central	West	Northeast
2011	0.123	0.100	0.136	0.639	0.173
2012	0.170	0.306	0.169	0.561	0.299
2013	0.229	0.392	0.344	0.580	0.252
2014	0.354	0.466	0.400	0.606	0.418
2015	0.505	0.558	0.531	0.652	0.527
2016	0.398	0.584	0.485	0.198	0.521
2017	0.559	0.665	0.585	0.309	0.455
2018	0.681	0.779	0.683	0.544	0.595
2019	0.806	0.861	0.821	0.704	0.763
2020	0.920	0.937	0.919	0.873	0.884
2021	0.795	0.903	0.785	0.685	0.640
2022	0.834	0.950	0.887	0.315	0.733

5. Analysis of the Interaction Effect between the Development of New Quality Productivity and the Transformation and Upgrading of Manufacturing Industry

5.1. Interaction effect analysis based on linkage modeling

In this paper, OLS (1), 2SLS (2), 3SLS (3) and iterative 3SLS (4) methods are used to analyze the interaction effect process of the level of development of new quality productivity and the transformation and upgrading of manufacturing industry, and the regression results are shown

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in Table 7. It shows that the improvement of the development level of new quality productivity significantly improves the level of regional manufacturing transformation and upgrading, and at the same time, the improvement of the level of manufacturing transformation and upgrading also significantly improves the level of regional new quality productivity development, and the two show a mutually reinforcing relationship, and the hypothesis H1 is verified. Among them, the estimation methods of OLS and 2SLS may ignore the interactions between the perturbation terms of different equations, and the estimation method of 3SLS is by efficiency in this aspect, so this paper adopts the estimation method of 3SLS in the follow-up.

Table 7. Results of joint equations

	(1)	(2)	(3)	(4)
Equation 1				
ln *education*	-0.003	-0.034**	-0.035**	-0.035**
	-0.009	-0.011	-0.011	-0.011
ln *research*	0.034***	0.037***	0.037***	0.037***
	-0.004	-0.004	-0.004	-0.004
ln *patent*	0.009*	0.016***	0.016***	0.016***
	-0.004	-0.004	-0.004	-0.004
manufacture	0.992***	0.718***	0.717***	0.717***
	-0.034	-0.06	-0.059	-0.059
_cons	-0.526***	-0.350***	-0.342***	-0.343***
	-0.064	-0.076	-0.075	-0.075
Equation 2				
ln *creativity*	-0.004	0.005	0.006	0.006
	-0.002	-0.004	-0.004	-0.004
ln *information*	0.007***	0.007***	0.006***	0.006***
	-0.002	-0.002	-0.002	-0.002
green	0.159***	0.180***	0.180***	0.180***
	-0.01	-0.012	-0.012	-0.012
efficiency	-1.314***	-2.096***	-2.105***	-2.105***
	-0.369	-0.474	-0.469	-0.47
productivity	0.582***	0.456***	0.455***	0.455***
	-0.019	-0.048	-0.047	-0.048
_cons	0.001	-0.055*	-0.056*	-0.056*
	-0.014	-0.024	-0.024	-0.024
N	360	360	360	360
r2	0.902	0.884	0.884	0.884

From the above table, it can be seen that the regional investment in R&D is an important factor affecting the development level of new quality productivity, which also confirms the necessity of increasing the investment in R&D. Innovation capacity is an important factor in promoting the development of regional new productivity[13].

In the manufacturing development equation, the results show that the improvement of the innovation level has a promoting effect on the development of China's manufacturing industry, and China's manufacturing industry is also facing the transformation from traditional manufacturing to intelligent manufacturing, and the innovation level is the core driving force. It shows that the improvement of informationization level can significantly promote the

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transformation and upgrading of the manufacturing industry. green is significantly positive in all models, indicating that the development of manufacturing industry should not only be intelligent, but also green, and the protection of the environment to reduce pollution can be conducive to the transformation and upgrading of the manufacturing industry. efficiency is significantly negative in all models, the reason may be that this paper selects the manpower and labor efficiency as a control variable, and the future transformation and upgrading of the manufacturing industry will inevitably be based on automation, automation, and automation. The transformation and upgrading of the future manufacturing industry is inevitably based on automation, no manual operation.

5.2. Joint equation model test

In order to guarantee the reliability of the measurement results, this paper, on the basis of the linkage equation, the model is tested for robustness by removing the control variables, and all the models have good explanatory strength from the table, and the specific results are shown in Table 8.

Table 8. Robustness test

	(5)	(6)	(7)	(8)
Equation 1				
ln *research*	0.038***		0.049***	0.037***
	-0.004		-0.002	-0.004
ln *patent*	0.010**	0.048***		0.018***
	-0.004	-0.003		-0.004
manufacture	0.780***	0.743***	0.793***	0.638***
	-0.047	-0.066	-0.055	-0.067
ln *education*		-0.044***	-0.016	-0.044***
		-0.012	-0.009	-0.012
_cons	-0.577***	-0.074	-0.511***	-0.291***
	-0.027	-0.079	-0.058	-0.08
Equation 2				
ln *creativity*	0.014*	0	0.006	
	-0.006	-0.005	-0.004	
ln *information*	0.007***	0.005**	0.006***	0.008***
	-0.002	-0.002	-0.002	-0.002
green	0.199***	0.163***	0.180***	0.167***
	-0.016	-0.013	-0.012	-0.008
efficiency	-2.766***	-1.791***	-2.078***	-1.586***
	-0.603	-0.486	-0.465	-0.317
productivity	0.337***	0.539***	0.453***	0.503***
	-0.07	-0.058	-0.047	-0.019
_cons	-0.110**	-0.014	-0.057*	-0.027**
	-0.034	-0.028	-0.024	-0.01
N	360	360	360	360
r2	0.888	0.861	0.889	0.872

In this paper, we do the robustness test of the model by deleting the control variables, and the models (5)-(8) are the regression results of deleting the control variables of higher education level, research and experimental development, innovation capacity, and innovation level

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respectively on the original basis. It shows that there is a stable interaction process between the development of new quality productivity and the transformation and upgrading of the manufacturing industry, the development of new quality productivity can significantly promote the transformation and upgrading of the manufacturing industry, and the improvement of the level of manufacturing industry transformation and upgrading will further promote the development of new quality productivity.

5.3. Heterogeneity test

Dividing China into eastern, central, western and northeastern regions according to geographic location, the estimation of the 3SLS of the joint equations model continues to be used to explore the heterogeneity characteristics of the interaction between the development of new quality productivity and the transformation and upgrading of the manufacturing industry. The regression results of the joint equation are shown in Table 9.

Table 9. Heterogeneity test

	East	Central	West	Northeast
Equation 1				
ln*education*	0.024	0.047***	-0.052***	-0.017
	-0.014	-0.014	-0.012	-0.011
ln*research*	0.009	0.014	0.045***	0.040***
	-0.005	-0.01	-0.005	-0.003
ln*patent*	0.005	0.009	-0.004	0.017***
	-0.006	-0.007	-0.004	-0.004
manufacture	1.411***	1.172***	0.236*	0.042
	-0.066	-0.138	-0.094	-0.157
_cons	-0.353**	-0.644***	-0.08	-0.465***
	-0.112	-0.121	-0.075	-0.067
Equation 2				
ln*creativity*	-0.023*	0.007*	0.002	-0.003
	-0.012	-0.003	-0.004	-0.003
ln*information*	0.006*	0.008***	0.002	0.005**
	-0.003	-0.002	-0.003	-0.002
green	-0.17	0.076**	0.148***	0.208***
	-0.107	-0.026	-0.012	-0.05
efficiency	-0.399	-3.064***	-1.784***	-1.940*
	-0.638	-0.827	-0.541	-0.809
productivity	0.808***	0.378***	0.423***	0.321***
	-0.107	-0.045	-0.115	-0.05
_cons	0.182	-0.045*	0.017	0.037*
	-0.097	-0.019	-0.019	-0.017
N	120	72	132	36
r2	0.933	0.868	0.61	0.959

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As can be seen from the table, the fitting coefficient of the manufacturing transformation and upgrading index (manufacture) in the new quality productivity development equation is higher in the eastern and central regions, and decreases in the western and northeastern regions in that order, indicating that the transformation and upgrading of the manufacturing industry in high-development-level regions has the strongest role in promoting the development of new quality productivity, and that the transformation and upgrading of the manufacturing industry in northeastern China has the most inconspicuous effect on the promotion of the development of new quality productivity. The possible reasons for this are that Beijing, Tianjin and Hebei in the eastern region have obvious advantages in manufacturing specialization, and the eastern and central regions themselves are in a leading position in terms of economic development, while the manufacturing industry in the central and western regions is relatively underdeveloped and still faces problems such as technological backwardness and lack of resources[15]. In the manufacturing industry development equation in the new quality productivity development level (productivity) and the fitting coefficient of the eastern, western, central to northeastern region decreasing trend. Hypothesis H2 is verified.

6. Conclusions and Suggestions

6.1. Conclusions

This paper utilizes China's provincial panel data to measure the coupling coordination degree of new quality productivity development and manufacturing transformation and upgrading and the evolution characteristics with practice and space from 2011 to 2022 by constructing the index system of new quality productivity development and manufacturing transformation and upgrading, and then examines the process of the interaction between the new quality productivity and the manufacturing industry development with the use of linkage model on this basis.

(1) From 2011 to 2022, the coupling coordination degree of China's new quality productivity and manufacturing development shows an overall trend of growth, and the overall coupling coordination level of the two is on the low side, but over time, it shows a trend of steady optimization towards a higher level of coupling coordination type, and spatially, it shows that the coupling coordination level of the eastern region enters into the high-quality coordination interval earlier than other regions.

(2) The regression results of the coupled equation model show that the new quality productivity and manufacturing transformation and upgrading have a significant mutual promotion effect, indicating that the improvement of the development level of new quality productivity significantly improves the level of regional manufacturing transformation and upgrading, while the improvement of the level of manufacturing transformation and upgrading also significantly improves the development level of regional new quality productivity.

(3) The results of the model robustness test show that there is a long-term stable equilibrium relationship between the new quality productivity and the development of the manufacturing industry, and the promotion effect between the two will continue for a longer period of time. The heterogeneity test shows that the driving effect of the development of new productivity is stronger than that of the transformation and upgrading of the manufacturing industry on the development of new productivity, and the development of new productivity in regions with high levels of development is stronger than that of regions with low levels of development on the transformation and upgrading of the manufacturing industry.

6.2. Suggestions

(1) Strengthen policy guidance. Improve the talent introduction policy as well as the incentive system to attract and retain technical talents with high level and strong professional ability. At

the same time, strengthen the management of subsidies for enterprise technological reform support funds, give tax incentives or financial support for R&D activities, encourage enterprises to increase innovation, and give play to the demonstration role of backbone enterprises in the industry. Cultivate a batch of leading enterprises in convergence application with strong innovation ability and outstanding brand influence, and encourage the backbone enterprises in the industry to improve the service quality of the industry based on their technological and industrial advantages. Create a favorable atmosphere for the transformation and upgrading of the manufacturing industry through policy training and promotion of benchmarking demonstration cases. Establish a sound assessment mechanism for the transformation and upgrading of the manufacturing industry, identify problems in a timely manner and take measures to solve them. Formulate and improve policies related to the transformation and upgrading of the manufacturing industry to provide strong protection for the development of the manufacturing industry[16].

(2) Technological innovation. Increase investment in research and development to enhance the ability of independent innovation. Enterprises should set up specialized research and development departments and invest sufficient resources in technological research and development. On the basis of maintaining independent innovation, enterprises should also actively introduce foreign advanced manufacturing technology and management experience, and enhance their own technical level and management ability through digestion, absorption and re-innovation. Make use of the new generation of information technology, such as the Internet of Things, big data, artificial intelligence, etc., to promote the digitalization, informatization and intelligent transformation of the manufacturing industry. This not only improves production efficiency and quality, but also reduces energy consumption and emissions, realizes green manufacturing, promotes the construction of new information infrastructure, and promotes the overall digitalization and upgrading of industrial chain enterprises in the park[2].

(3) Strengthen cooperation among industries, universities and research institutes. Make full use of the resources of major universities and research institutes, increase the integration of production, learning and research, and enhance the R&D and innovation capacity of the manufacturing industry. Encourage universities and enterprises to "pair" relevant specialties to form a synergy of technological innovation, and promote the transformation of scientific and technological achievements into actual productivity, so that the supply and demand for scientific research is more accurately matched. Actively play the role of universities and scientific research institutions in R&D innovation at the source, take the initiative to docking production and manufacturing enterprises technology development needs, jointly carry out technological research and transformation of results, to promote universities and scientific research institutions to carry out small pilot, pilot and industrialization of scientific research results to open up the results of the R&D and the application of the channel, to help the manufacturing industry to develop. Encourage and support manufacturing enterprises to set up manufacturing innovation centers, laboratories, technology innovation centers and other platforms and carriers, to enhance the enterprise technology research and development capabilities, enhance the core competitiveness of enterprises, and extend the development of high-end links to the industrial chain.

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References

[1] Liu JJ. Research on the impact of stakeholders' green concern on corporate green innovation under digital business model scenario[D]. Beijing University of Chemical Technology, 2023.

[2] Wu Yuxue. Research on the transformation and upgrading capability of manufacturing industry in Jiangsu Province under the background of industrial digitalisation[D]. Nanjing University of Posts and Telecommunications, 2021.

[3] Zhu Yaping. Research on the impact of industrial integration on manufacturing efficiency and its transmission mechanism[D]. Nanjing University of Finance and Economics,2022.

[4] ZHU Fu-Xian,LI Rui-Xue,XU Xiao-Li,et al. Construction and spatial and temporal evolution of new quality productivity indicators in China[J]. Industrial Technology and Economics,2024,43(03):44-53.

[5] SONG Jia,ZHANG Jinchang,PAN Yi.A study on the impact of ESG development on firms' new-quality productivity-empirical evidence from Chinese A-share firms[J/OL]. Contemporary Economic Management,1-13[2024-03-25].

[6] HAN Gang,ZHUO Sijia. The impact of green finance on the transformation and upgrading of manufacturing industry under the perspective of spatial spillover[J]. Journal of Shenyang University (Social Science Edition),2024(01):44-54.

[7] CHEN Tingqiang, LI Xianzhao, LI Zeyu, LIU Meng. Study on the driving effect of energy consumption and financial support on green innovation in manufacturing industry[J]. Statistics and Information Forum,2024(03):66-79.

[8] Fang Yuan. Research on the impact of heterogeneous environmental regulation on green transformation of manufacturing industry--Based on spatial Durbin model[J]. Small and Medium-sized Enterprises Management and Technology,2023(12):34-36.

[9] Wang Chuanyang. Study on the interaction between network power and knowledge innovation in Chinese cities[D]. Shandong University of Technology,2023.

[10] Liu Jiahui. Study on the relationship between demographic structure and housing price in China based on the linkage equation model[D]. Tsinghua University,2022.

[11] WANG Jue,WANG Rongji. New Quality Productivity: Indicator Construction and Spatial and Temporal Evolution[J]. Journal of Xi'an University of Finance and Economics,2024,37(01):31-47.

[12] Liu Jing. Measurement and Analysis of Influencing Factors of Manufacturing Transformation and Upgrading Capability[D]. Liaoning University,2023.

[13] Zhu Yajun. Research on the impact of digital economy on the transformation and upgrading of China's manufacturing industry [D]. Hebei University of Economics and Trade, 2023.

[14] Pu Zewen. The impact of government R&D funding on the transformation and upgrading of China's manufacturing industry[D]. Shanxi Normal University,2022.

[15] Lin Jianwen. Research on the impact of input servitising on total factor productivity of China's manufacturing industry[D]. Northwest Normal University, 2023.

[16] Xiao Ting. The impact of the return of manufacturing in developed countries on the transformation and upgrading of China's manufacturing industry [D]. Lanzhou University,2019.