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Research on the Measurement of New Productivity Levels and Regional Differences among Provinces in China

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Abstract: This paper constructs a theoretical framework for new-quality productive forces. It first explores their essential characteristics from the dimensions of labor, production factors, and technological innovation. Then, using statistical methods such as the entropy method and the Dagum Gini coefficient method, it conducts a quantitative assessment of the level of new-quality productive forces in 30 provinces in China from 2012 to 2022. The study finds that the overall level of new-quality productive forces in provinces across the country has achieved significant growth, but there are significant regional differences, with the eastern region having the highest level and the western region the lowest. Furthermore, there is no convergence in development within the four major regions, and inter-regional differences continue to expand. Based on this conclusion, this paper proposes suggestions such as precisely focusing on regional differences in policy formulation, strengthening regional coordinated development, promoting sustainable development in various regions, and establishing a dynamic monitoring mechanism. The aim is to provide theoretical basis and policy reference for high-quality economic development in China.

Keywords: New Quality Productivity; Entropy method; Dagum Gini coefficient method.

1. Introduction

Against the backdrop of profound adjustments in the global economic landscape and the rapid evolution of technological revolution, the connotation of productive forces continues to be enriched and its denotation is constantly expanding. As the core driving force for high-quality economic development, new-quality productive forces are gradually becoming the focus of research in academia and policy-making circles. The core logic of new-quality productive forces lies in relying on technological innovation breakthroughs, efficient allocation of production factors, and transformation and upgrading of industrial structure to promote qualitative changes and energy level improvement in productive forces, thereby opening up new spaces and injecting new vitality into economic growth. However, at present, China's regional economic development still faces imbalances, which directly lead to significant disparities in the development process of new-quality productive forces across different regions. This not only hinders the process of coordinated regional development but also, to some extent, limits the overall effectiveness of high-quality economic development nationwide.

In recent years, China has achieved phased results in both the theoretical construction and practical exploration of new-quality productive forces. Scholars have conducted in-depth analyses on the core connotation of new-quality productive forces from different perspectives such as labor forms, production factor allocation, and technological innovation paths (Wang Jue, Wang Rongji, 2024), considering it as the core driving force for promoting high-quality economic development. [1] However, existing research has certain limitations, mostly focusing on theoretical discussions, and there are deficiencies in the quantitative measurement of new-quality productive forces and systematic analysis of regional differences. Especially against the backdrop of uneven regional economic development in China, how to accurately measure the development level of new-quality productive forces in various regions and formulate targeted policy measures to narrow the development gap between regions has become a key issue that needs to be urgently addressed.

The research objective of this paper is to establish a theoretical framework for new-quality productive forces and to quantitatively evaluate the level of new-quality productive forces across 30 provinces in China from 2012 to 2022, utilizing statistical tools such as the entropy method and the Dagum Gini coefficient method. During the research process, not only was the overall trend of changes in the national level of new-quality productive forces analyzed, but also an in-depth exploration of regional development disparities and dynamic evolution characteristics was conducted. Through a systematic analysis of the level of new-quality productive forces in various regions, this paper clarifies the reality of regional imbalances in the development of new-quality productive forces in China, and accordingly proposes a series of policy recommendations, including precisely addressing regional disparities, strengthening regional coordinated development, assisting regions in continuously promoting the construction of new-quality productive forces, and establishing a dynamic monitoring mechanism. These research findings provide theoretical support and policy references for the high-quality development of China's economy, thereby promoting the achievement of regional coordinated development and sustainable economic growth goals.

2. The Essential Characteristics of New Productive Forces

Zhou Wen and Xu Lingyun (2023) pointed out that productive forces are the objective material forces formed by humans in the process of production and labor as they utilize and transform the natural world to meet their own needs. [2] The core components of productive forces include laborers,

labor objects, and means of production. The laborers invest their physical and mental energy into the labor objects and means of production, achieving an organic combination of the two, which is the necessary prerequisite for productive forces to transform from a potential form into a real form

2.1. New Productive Forces and Laborers

The perspective on labor talent under the new productive forces encompasses three core dimensions: concept reshaping, skill cultivation, and efficiency enhancement. At the conceptual level, it is necessary to stimulate the creative vitality of social entities, shape innovative mission cognition, and build an innovation-oriented environment and atmosphere, thereby consolidating the ideological foundation for talent development. In the skill dimension, targeted cultivation of workers' adaptive technical skills should be centered around the needs of industrial structure transformation, forming a human capital system that supports economic development. In the efficiency dimension, it is crucial to focus on improving labor productivity, alleviate structural contradictions in the current development stage, and provide core momentum for the upgrading of industries towards high-end and intelligent development.

2.2. New Productive Forces Labor Object

The characteristics of new-quality productive forces in the dimension of labor objects are primarily manifested in two aspects: the development of new-quality industries and the optimization of the ecological environment. In the field of new-quality industries, facing the challenges posed by the wave of international industrial transfer, China needs to focus on promoting coordination, linkage, and deep integration among industries, thereby establishing a modern industrial system that is compatible with high-quality development. In the field of the ecological environment, given the environmental issues caused by traditional economic development models, new-quality productive forces emphasize the awareness of ecological priority, requiring a reduction in the degree of ecological damage during industrial transfer, and relying on digital technology empowerment to simultaneously achieve industrial transformation and upgrading and ecological circular development.

2.3. New Productive Forces and Means of Production

Production materials encompass both tangible and intangible assets. Tangible materials include traditional and digital infrastructure, with digital infrastructure capable of efficiently processing data and creating economic value. Intangible materials are embodied through technological innovation and digitization. Technological innovation is the core of new productive forces, emphasizing the role of innovation in driving technological change. Digitization aids in enterprise transformation and the development of the digital economy, promoting the integration of digital technology with the real economy.

3. Calculation of the Level of New Productive Forces

3.1. Construction of Evaluation Framework

Based on the definition of the connotation of new-new productive forces, and referring to the approach of Wang Jue and Wang Rongji (2024), a comprehensive evaluation framework for new-new productive forces is constructed from three dimensions: laborers, labor objects, and means of production.

3.1.1. Worker dimension

This study selects seven core indicators for comprehensive measurement. The average years of education per capita are used to measure the average level of regional human capital. Drawing on the research of Zhao Yaman (2024), stimulating the creative vitality and initiative of workers is the core essence of developing new-quality productive forces. [3] The number of R&D personnel per 100 employees and regional entrepreneurial activity reflect the level of activity in the overall innovation and entrepreneurship ecosystem from the dimensions of innovation input and entrepreneurial practice, respectively, and are important indicators for measuring the development level of new-quality workers. In specific measurements, the average years of education per capita reflect the overall human capital accumulation of the region, constituting the quality foundation of new-quality productive forces; the structure of human capital reflects the distribution of workers' education levels. The development of new-quality productive forces requires both leading talents who can break through key core technologies and create new production tools, as well as large-scale application talents who can proficiently use new-quality production materials. Therefore, the upgrading and rationalization of the structure of human capital are key to supporting its sustainable development.

3.1.2. Labor object dimension

An evaluation system consisting of six indicators has been constructed. Drawing on the viewpoint of Liu Hao et al. (2025), the core of the new labor object lies in the cultivation of future industries and the upgrading of traditional industries. [4] In terms of future industries, the focus is on strategic emerging industries and frontier technology industries: the former is measured based on the scale of employees in the industry, while the latter uses the installation density of industrial robots as a proxy indicator. In terms of the transformation and upgrading of traditional industries, the main assessment is on the degree of their shift towards intelligence, greenification, and innovation: the level of intelligence is characterized by the number of artificial intelligence enterprises, the degree of greenification is jointly measured by industrial waste gas and wastewater emissions per unit of output value, and the comprehensive utilization efficiency of industrial solid waste, while the level of innovation is primarily measured by the number of invention patents per capita.

3.1.3. Production material dimension

This study has set up 8 tertiary indicators for systematic measurement. Traditional infrastructure is measured by highway mileage and railway mileage, while digital infrastructure is reflected by fiber length and per capita number of Internet broadband access ports; overall energy consumption is measured by the ratio of energy consumption to GDP, and renewable energy consumption is represented by the ratio of renewable energy power consumption to total electricity consumption; the number of patents per capita is the ratio of the number of patent grants to the total population, and R&D investment is measured by the ratio of R&D expenditure to GDP; referring to the research of Zhao Tao et al. (2020), the digital economy is measured from two dimensions: Internet development and digital financial inclusion; enterprise digitization is measured by using

keywords appearing in the annual reports of listed companies, locating enterprises at the provincial level, and calculating the average of the sum of word frequencies [5].

3.2. Measurement Method

3.2.1. Entropy method

The entropy method is an objective weighting method based on information entropy. Its principle is to determine the weight based on the amount of information contained in each indicator data: the smaller the entropy value of an indicator, the greater the amount of information it contains, and the more significant its distinguishing effect in the evaluation system, thus the higher the weight it is assigned; vice versa. Before assigning weights to indicators, it is necessary to preprocess the original indicator data. Referring to the research of Li Hongchun (2020), this paper adopts the range normalization method to process the indicator data [6].

For positive indicators:

$$x_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \tag{1}$$

For reverse indicators:

$$x_{ij} = \frac{\max(x_j) - x_{ij}}{\max(x_j) - \min(x_j)} \tag{2}$$

$$\omega_{ij} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \tag{3}$$

Calculate the information entropy of the indicator e_j, where m is the number of years of evaluation:

$$e_j = -\frac{1}{\ln m} \sum_{i=1}^{m} \omega_{ij} \ln \omega_{ij} \tag{4}$$

Calculate the redundancy of information entropy ρ_j:

$$\rho_j = 1 - e_j \tag{5}$$

and the required indicator weights λ_j:

$$\lambda_j = \frac{\rho_j}{\sum_{j=1}^{n} \rho_j} \tag{6}$$

Calculate the level of new quality productive forces based on the proportion of indicators ω_{ij} and the corresponding weights λ_j:

$$U_i = \sum_{j=1}^{m} \lambda_j \tag{7}$$

3.2.2. Dagum Gini coefficient and its decomposition method

The Dagum Gini coefficient and its decomposition method is a method capable of measuring regional differences. The Gini coefficient can be decomposed into three parts: within - region disparity, between - region disparity, and trans - var component (Zhang et al., 2022). [7] In this paper, the above - mentioned method is used to calculate and decompose the Gini coefficients of various regions in China respectively. The overall Gini coefficient is defined as shown in Equation (8), where k represents the number of regional divisions, n represents the number ofprovinces, $Y_{ji}(Y_{hr})$ represents the level of new quality productive forces of province i(r) in regionj(h), $n_j(n_h)$ represents the number of provinces in regionj(h), and $\overline{Y}$ represents the average level of new quality productive forces of all provinces.

$$G = \frac{\sum_{j=1}^{k} \sum_{h=1}^{k} \sum_{i=1}^{n_j} \sum_{r=1}^{n_h} |Y_{ji} - Y_{hr}|}{2n^2 \overline{Y}} \tag{8}$$

$$G_{jj} = \frac{\frac{1}{2\overline{Y}} \sum_{i=1}^{n_j} \sum_{r=1}^{n_j} |Y_{ji} - Y_{jr}|}{n_j^2} \tag{9}$$

$$G_{jh} = \frac{\sum_{i=1}^{n_j} \sum_{r=1}^{n_h} |Y_{ji} - Y_{hr}|}{n_j n_h (Y_j + \overline{Y_h})} \tag{10}$$

Equation (9) and Equation (10) represent the Gini G_{jj} coefficient of region j and the GiniG_{jh} coefficient between region j and region h respectively. Among them, $\overline{Y_j}(\overline{Y_h})$ it represents the average value of the new quality productive forces in region j(h).

The definitions of the following variables are:

$$P_j = \frac{n_j}{n} \tag{11}$$

$$S_j = \frac{n_j \overline{Y_j}}{n\overline{Y}} \tag{12}$$

$$M_{jh} = \int_0^{\infty} dF_j(Y) \int_0^{Y} (Y - x) dF_h(x) \tag{13}$$

$$N_{jh} = \int_0^{\infty} dF_h(Y) \int_0^{Y} (Y - x) dF_j(x) \tag{14}$$

$$D_{jh} = \frac{M_{jh} - N_{jh}}{M_{jh} + N_{jh}} \tag{15}$$

D_{jh} represents the relative impact of new quality productive forces between region j and region h, and M_{jh} represents the difference in the level of new quality productive forces between regions, that is, in regions j and h, the mathematical expectation of the sum of all sample values where $Y_{ji} - Y_{hr} > 0$. N_{jh} represents the trans - var first - order density distribution function. The within - region disparity G_w, the between - region disparityG_{nb}, and the trans - var component G_t are as follows:

$$G_{ww} = \sum_{j=1}^{k} G_{jj} P_j S_j \tag{16}$$

$$G_{nb} = \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} D_{jh} (P_j S_h + P_h S_j) \tag{17}$$

$$G_t = \sum_{j=2}^{k} \sum_{h=1}^{j-1} G_{jh} (P_j S_h + P_h S_j)(1 - D_{jh}) \tag{18}$$

3.3. Data and Explanation

The new quality productive forces indicator system consists of 27 sub - indicators. The sample scope is the panel data of 30 provinces in China (excluding Hong Kong, Macau, Taiwan, and Tibet) from 2012 to 2022. The data sources include the China Industrial Statistics Yearbook, China Energy Statistics Yearbook, China Environmental Statistics Yearbook, and the statistical yearbooks of various provinces, etc. Due to the presence of a small amount of missing data in the original data, in order to reduce sample loss, the missing data are processed using the analogical method or the interpolation method.

3.4. Estimation Results

Based on the data collection and processing work completed in the previous sections, and in conjunction with the newly constructed comprehensive evaluation framework for new-quality productivity, this study calculates the level of new-quality productivity across 30 provinces in China from 2012 to 2022. The specific results are presented in Table 1. Analyzing from the perspective of growth rate, all provinces have achieved positive improvements in their new-quality productivity levels, with Guangdong Province experiencing the highest growth rate at 168% and Guangxi Province experiencing the lowest at 35%. At the mean level, there is a

significant development gap between regions, with the eastern region having the highest average level of new-quality productivity and the western region having the lowest.

Table 1. The Levels of New quality productive forces of 30 Provinces across the Country from 2012 to 2022

		2012	2014	2016	2018	2020	2022	Growth Rate
Eastern Region	Beijing City	0.1633	0.1933	0.2277	0.2628	0.2945	0.417	155%
	Tianjin City	0.0983	0.1146	0.1321	0.1497	0.1763	0.206	110%
	Hebei Province	0.1	0.1119	0.1243	0.1447	0.1586	0.1762	76%
	Shandong Province	0.1266	0.1435	0.1607	0.1901	0.2259	0.292	131%
	Jiangsu Province	0.1794	0.1904	0.2129	0.2621	0.3172	0.4089	128%
	Shanghai City	0.1296	0.1426	0.1598	0.1981	0.2403	0.3477	168%
	Zhejiang Province	0.1732	0.1809	0.2224	0.2348	0.2799	0.3782	118%
	Fujian Province	0.1048	0.2999	0.1361	0.1559	0.1808	0.22	110%
	Guangdong Province	0.179	0.1982	0.2212	0.3006	0.3551	0.5093	185%
	Hainan Province	0.0416	0.0491	0.0598	0.0706	0.0829	0.1065	156%
	Regional Average	0.1296	0.1624	0.1657	0.1969	0.2311	0.3062	136%
Central Region	Shanxi Province	0.0845	0.0921	0.0926	0.1112	0.1183	0.1329	57%
	Anhui Province	0.0871	0.0961	0.1122	0.1364	0.1552	0.2149	147%
	Jiangxi Province	0.0785	0.0861	0.1038	0.1135	0.1378	0.1637	108%
	Henan Province	0.091	0.0955	0.1118	0.1338	0.1425	0.1653	82%
	Hubei Province	0.1226	0.1341	0.1501	0.169	0.1916	0.2424	98%
	Hunan Province	0.1065	0.109	0.115	0.1252	0.1449	0.187	76%
	Regional Average	0.095	0.1022	0.1143	0.1315	0.1484	0.1844	94%
Western Region	Inner Mongolia	0.0855	0.1005	0.1096	0.1176	0.1257	0.142	66%
	Guangxi Province	0.0835	0.0919	0.0906	0.0968	0.1038	0.1128	35%
	Chongqing City	0.0905	0.0964	0.1118	0.1275	0.14	0.1619	79%
	Sichuan Province	0.14	0.1581	0.1681	0.1932	0.2072	0.2362	69%
	Guizhou Province	0.0722	0.08	0.0864	0.0961	0.1081	0.1123	56%
	Yunnan Province	0.1145	0.1246	0.1391	0.1482	0.1483	0.1591	39%
	Shaanxi Province	0.0877	0.0995	0.1122	0.1328	0.1494	0.1861	112%
	Gansu Province	0.058	0.0699	0.0799	0.0919	0.1047	0.1143	97%
	Qinghai Province	0.0768	0.0809	0.094	0.1142	0.1224	0.1291	68%
	Ningxia	0.0451	0.055	0.0633	0.0903	0.0971	0.1148	154%
	Xinjiang	0.0695	0.0805	0.0868	0.0959	0.1007	0.1157	67%
	Regional Average	0.0839	0.0943	0.1038	0.1186	0.1279	0.144	72%
Northeastern Region	Liaoning Province	0.0959	0.1082	0.1122	0.1279	0.1392	0.1616	68%
	Jilin Province	0.0679	0.0813	0.0934	0.1016	0.1169	0.127	87%
	Heilongjiang Province	0.0723	0.0851	0.0887	0.0984	0.1086	0.1192	65%
	Regional Average	0.0787	0.0915	0.0981	0.1093	0.1216	0.1359	73%

4. Analysis of the Level of New Productive Forces

4.1. Temporal Trends and Regional Differences in the Level of New Productive Forces

4.1.1. Analysis of the Overall Level of New Productive Forces

Between 2012 and 2022, the overall level of new-quality productivity across 30 provinces in China experienced a significant leap, with a cumulative increase of 155%, fully reflecting the systematic progress China has made in economic transformation, green development, and technological innovation. The improvement in new-quality productivity not only signifies a general increase in economic efficiency across various provinces but also reflects the continuous advancement of economic structural optimization and high-quality development pathways. Looking at the overall trend, the national productivity level has significantly increased over the past decade, with particularly notable progress in innovation-driven and green, low-carbon fields.

All provinces have achieved positive growth, indicating that China's economic transformation has formed a broad and positive development trend. In terms of growth patterns, the eastern region maintains a leading position in absolute terms, while the central and western regions, as well as the northeastern region, exhibit faster growth rates, reflecting their accelerated catching-up in economic structural optimization and emerging industry cultivation.

In terms of regional disparities, despite the overall improvement in the national level of new productive forces, there is significant differentiation in the growth rates across regions. The eastern region has maintained a relatively stable growth trend with a moderate growth rate; whereas the central and western regions, as well as the northeastern region, have shown stronger growth momentum, with growth rates significantly higher than the national average. This difference is closely related to the aforementioned regions' continuous efforts in recent years to strengthen industrial upgrading, accelerate infrastructure construction, and actively promote green and low-carbon transformation.

4.1.2. Analysis of the level of new productive forces in the four major regions

This study divides the provinces in China into four major regions based on their geographical locations: the eastern, central, western, and northeastern regions. It focuses on analyzing the dynamic trends of new-quality productivity development in each region from 2012 to 2022. Combining the data collation results with the preceding charts, it can be observed that the levels of new-quality productivity in all four regions have shown a year-on-year increase during the study period. The specific characteristics are as follows: The level of new-quality productivity in the eastern region has always been higher than the national average, increasing from 0.1296 in 2012 to 0.3062 in 2022, with a significant growth rate; the central, western, and northeastern regions have been consistently lower than the national average, and there are obvious regional differentiation characteristics. Specifically, the level of new-quality productivity in the northeastern region increased from 0.0787 in 2012 to 0.1359 in 2022. From 2012 to 2014, it was close to the national average, but the gap gradually widened after 2014, and it was surpassed by the central and western regions from 2018 onwards. The initial development levels of the central and western regions were similar (from 2012 to 2014), but their trajectories diverged from 2015 onwards, with the central region accelerating its growth rate and gradually surpassing the western region.

Table 2 presents the Gini coefficient of new-quality productive forces in the four major regions from 2012 to 2022, further reflecting the internal development disparities within each region. The eastern region has a relatively high level of new-quality productive forces overall, but the Gini coefficient fluctuates, rising from 0.181 in 2012 to 0.224 in 2022, with notable fluctuations in 2015 (down to 0.171) and 2021 (upward). The Gini coefficient in the central region increased from 0.085 in 2012 to 0.109 in 2022, with a small increase and overall balanced development, only gradually recovering after dropping to a low of 0.074 in 2017. The Gini coefficient in the western region decreased from 0.158 in 2012 to 0.134 in 2022, showing an overall downward trend but with significant fluctuations, slightly recovering after reaching a low of 0.133 in 2016. The Gini coefficient in the northeast region has been at a low level for a long time, decreasing from 0.079 in 2012 to 0.069 in 2022, and slightly recovering after reaching a minimum of 0.053 in 2015.

In summary, the development of new productive forces in the four major regions exhibits differentiated characteristics: the eastern region has a high level but significant fluctuations, the central region has a low level but stable development, the western region has a low level and significant fluctuations, and the northeastern region remains in a low-level range. This result indicates that there is a significant gap in the development of new productive forces among different regions in China, and there is obvious heterogeneity in the development trends of each region.

Table 2. Dagum Gini Coefficients of New Productive Forces Development Levels in the Four Major Regions of China from 2012 to 2022

year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Eastern Region	0.181	0.176	0.211	0.171	0.173	0.181	0.188	0.188	0.193	0.218	0.224
Central Region	0.085	0.080	0.079	0.077	0.078	0.074	0.077	0.075	0.079	0.093	0.109
Western Region	0.158	0.150	0.149	0.149	0.144	0.133	0.130	0.139	0.125	0.127	0.134
NortheasternRegion	0.079	0.059	0.065	0.073	0.053	0.049	0.060	0.055	0.056	0.060	0.069

According to the table data, the main sources of differences in new quality productivity across the four major regions are inter-regional disparities (Gb), intra-regional disparities (Gw), and super-variability density (Gt). Among them, inter-regional disparities (Gb) contribute the most, with an average value of 0.1320, accounting for 62.47%; intra-regional disparities (Gw) come next, with an average value of 0.0474, accounting for 23.97%; super-variability density (Gt) contributes the least, with an average value of 0.0332, accounting for 21.36%. From the perspective of temporal changes, intra-regional disparities remain stable, fluctuating in a "U" shape; inter-regional disparities increase year by year, indicating that regional disparities are widening; super-variability density gradually decreases, indicating that the impact of fluctuation factors on differences in new quality productivity is gradually weakening.

Table 3. Dagum Decomposition of New Productive Forces Development Levels in the Four Major Regions of China from 2012 to 2022

year	Regional Gap			Contribution Rate (%)			Dagum Gini Coefficient
	Gw	Gb	Gt	Gw	Gb	Gt	
2012	0.0474	0.1081	0.0422	23.97%	54.67%	21.36%	0.1977
2013	0.0453	0.1037	0.0416	23.78%	54.39%	21.83%	0.1906
2014	0.0515	0.1318	0.0389	23.16%	59.34%	17.50%	0.2222
2015	0.0448	0.1082	0.0395	23.28%	56.21%	20.51%	0.1924
2016	0.0446	0.1155	0.0353	22.83%	59.10%	18.07%	0.1954
2017	0.0443	0.1197	0.0337	22.39%	60.55%	17.07%	0.1977
2018	0.0455	0.1270	0.0315	22.31%	62.27%	15.42%	0.2040
2019	0.0464	0.1340	0.0297	22.08%	63.80%	14.12%	0.2101
2020	0.0461	0.1451	0.0267	21.16%	66.57%	12.27%	0.2179
2021	0.0517	0.1749	0.0223	20.77%	70.27%	8.96%	0.2489
2022	0.0541	0.1843	0.0233	20.68%	70.40%	8.92%	0.2617
Mean	0.0474	0.1320	0.0332	23.97%	62.47%	21.36%	0.2126

To assess whether there is a convergence characteristic in the overall development level of new-quality productive forces across the country, this paper adopts the approach of Sun Liwei and Guo Junhua (2024) and employs the β

convergence model for analysis. [8] The β convergence model is primarily designed to examine whether provinces with lower levels of new-quality productive forces can narrow the gap with provinces with higher levels of development at a certain convergence rate.

The results of the β convergence test are presented in Table 4 below. The test indicates that the estimated β coefficient is significantly positive, suggesting that the overall development level of new-quality productive forces across the country does not exhibit β convergence characteristics. This means that provinces with lower levels of new-quality productive forces cannot rapidly converge towards those with higher levels, leading to a continuous widening of regional disparities. However, the absolute value of the coefficient estimate is close to 0.1, indicating that this widening trend is slow. The primary reason for this result is the significant differences in economic development levels, policy environments, resource allocation, and market conditions across different regions, and these differences are expected to persist for an extended period of time.

Table 4. β-Convergence Test Results of the National New Productive Forces Development Level

Region	National
β	0.1005^{***} (0.0171)
N	300
R^2	0.1041

Note: The values in square brackets are the standard errors of the regression coefficients. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

5. Conclusions and Suggestions

This article constructs a multi-dimensional comprehensive evaluation index system for new-quality productive forces and employs various statistical analysis methods to quantitatively assess the level of new-quality productive forces in 30 provinces in China from 2012 to 2022. The research indicates that the overall level of new-quality productive forces in all provinces across the country has continued to grow, but there are significant differences in growth rates; the eastern region has a high level with fluctuations, the central region has a lower level with stability, the western region has large fluctuations and a low overall level, and the northeastern region remains consistently low, with significant regional differences; in the convergence analysis, the development level of new-quality productive forces in 30 provinces in China does not exhibit β convergence. This result suggests that due to significant and long-standing differences in economic development levels, policy environments, resource allocation, and market conditions among different regions, the gap in the level of new-quality productive forces between regions will continue to widen, albeit at a relatively slow rate.

Based on the above research findings, in order to promote the high-quality development of China's new productive forces, it is recommended to implement a differentiated regional development strategy. The eastern region should focus on innovation and upgrading, the central region should strengthen industrial transformation, the western region should develop a characteristic economy, and the northeastern region should accelerate the transformation of traditional industries. At the same time, regional coordination should be promoted to facilitate the flow of technology, capital, and talent among the eastern, central, and western regions, and strengthen cross-regional industrial cooperation. Increase investment in scientific and technological innovation, promote the integration of industry, academia, and research, accelerate the transformation of research outcomes, and optimize talent training and introduction mechanisms. Promote green and low-carbon development, improve fiscal, tax, and financial support policies, and optimize the business environment. Strengthen international scientific and technological cooperation, participate in the global innovation network, and enhance competitiveness. Establish a dynamic monitoring and evaluation mechanism, regularly adjust policies, and ensure the sustained and healthy development of new productive forces.

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References

[1] Wang, J., & Wang, R. J. (2024). New quality productive forces: Index Construction and Spatiotemporal Evolution [J]. Journal of Xi'an University of Finance and Economics, 37(01), 31-47.

[2] Zhou, W., & Xu, L. Y. (2023). On New Productive Forces: Connotation, Characteristics, and Key Focuses [J]. Reform, (10), 1-13.

[3] Zhao, Y. M. (2024). Analysis of the Concept of New Productivity and Construction of Evaluation Indicator System [J]. Business Economics, (10), 138-141.

[4] Liu, H., Lei, Y. Y., & Yang, H. L. (2025). New Productivity of Chinese Cities: Level Measurement, Regional Differences, and Spatial Evolution [J]. Statistics and Management, 40(06), 84-93.

[5] Zhao, T., Zhang, Z., & Liang, S. K. (2020). Digital Economy, Entrepreneurial Activity, and High-quality Development: Empirical Evidence from Chinese Cities [J]. Management World, 36(10), 65-76.

[6] Li, H. C. (2022). Evaluation Model of Rural Tourism Environmental Carrying Capacity Based on Entropy Method [J]. Journal of Hebei North University (Natural Science Edition), 38(09), 50-56.

[7] Zhang, Z. Q., Zhang, T., & Feng, D. F. (2022). Research on Regional Differences, Dynamic Evolution, and Convergence of Carbon Emission Intensity in China [J]. Journal of Quantitative Economics and Technical Economics, 39(04), 67-87.

[8] Sun, L. W., & Guo, J. H. (2024). Construction and Empirical Measurement of the Evaluation Index System for New Productivity [J]. Statistics and Decision, 40(09), 5-11.