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Research on the Impact of New Quality Productivity on Urban Economic Resilience

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Abstract

With an innovation-led orientation, efficiency and intensification, and high technology intensity, new quality productive forces have become a key driver of urban economic resilience. Drawing on the three-factor theory of productive forces, this paper constructs an evaluation index system for new quality productive forces and, using panel data for 284 prefecture-level Chinese cities from 2012 to 2022, employs a two-way fixed-effects model to empirically examine their impact on urban economic resilience. Results show that new quality productive forces significantly enhances urban economic resilience. The effect is heterogeneous - stronger in cities with weaker science-and-technology foundations, east of the Hu Huanyong Line, and in resource-based cities. Mechanism tests indicate three pathways: digital technological innovation, industrial agglomeration, and optimization of human-capital structure. Policy implications are threefold: (1) consolidate the foundations for NQPF by improving industrial layout and institutions to raise cities' resistance and recovery capacity; (2) strengthen the human-capital bridge through higher education investment, talent policies, and vocational training; and (3) implement regionally differentiated strategies - the east should prioritize innovation-led upgrading and cluster deepening, while the west should accelerate transformation and close infrastructure gaps - supported by stronger mechanisms for coordinated regional development.

JEL classification numbers: R11, R58.
Keywords: New Quality Productive Forces, Economic Resilience, Digital Technology Innovation, Industrial Agglomeration, Human Capital Level.

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1. Introduction

The world today is undergoing profound changes on a scale unseen in a century, with significantly increased uncertainties in the external environment. Enhancing urban economic resilience to cope with external shocks and ensure stable economic performance has become a major strategic national need. The 2024 Government Work Report explicitly called for “accelerating the development of new quality productive forces,” positioning it as “an important engine for driving high-quality development.” As a new form of productive forces characterized by innovation-driven development, high quality, and advanced essence, new quality productive forces are profoundly restructuring industrial systems and growth models. They not only give rise to emerging strategic industries and future industries but also inject new momentum into traditional sectors, offering unprecedented opportunities for cities to break away from traditional development path dependency and build a more resilient economic system. Against this backdrop, an in-depth exploration of how new quality productive forces can empower cities to enhance economic resilience holds significant theoretical and practical relevance.

Current academic research on new quality productive forces primarily focuses on its theoretical connotations, measurement methods, and practical effects. At the theoretical level, scholars generally agree that new quality productive forces represent a new form of productive forces driven by innovation, characterized by optimized quality and efficiency, and defined by advanced technology. Extensive studies have been conducted to explain their formation logic, component elements, and the distinctive features of their "new quality". Regarding measurement, research has followed two main approaches: some scholars extend traditional productivity frameworks, attempting to construct indicators from dimensions such as "quantity, quality, innovation" or "micro-meso-macro" (Cai and He, 2024; Zhu, Yang and Li, 2024). These measurement results generally indicate significant regional disparities in China's new quality productive forces levels—higher in the eastern region and lower in the central and western regions—alongside an overall upward trend. Other studies emphasize emerging dimensions, incorporating features such as innovation-driven development, green and low-carbon transition, and digital empowerment. These efforts build evaluation systems covering new industries, new models, new drivers, or dimensions like technology, digitalization, and green development to assess development dynamics in national strategic regions (Liu et al., 2024; Lu, Guo and Wang, 2024). At the practical level, existing research explores the positive effects of new quality productive forces in promoting high-quality economic development, accelerating new industrialization, and fostering common prosperity. These effects are realized through pathways such as integrating scientific and technological innovation resources, deepening institutional reforms, fostering emerging industries, and promoting the integration of the digital and real economies (Wang, Hou and Li, 2025; Li and Wang, 2024; Li and Yu, 2024; Chen and Wu, 2024).

Meanwhile, economic resilience, as a core capability for coping with external uncertainties, has seen its concept extended from the fields of engineering and ecology to the realm of economics, focusing specifically on a city's capacity for resistance, adaptation, and recovery in the face of shocks (Pines, 2005; Wang et al., 2024). Scholars have identified multidimensional factors influencing urban economic resilience: in terms of structural factors, the degree of industrial diversification helps disperse risks (Xia and Liu, 2011; Xu and Deng, 2020), while the level of digitalization enhances response and adaptation efficiency (Tian and Guo, 2023); regarding factor endowment factors, high-quality human capital is key to supporting transformation and innovation (Zhou and Qi, 2023), and ample financial depth can effectively cushion shocks; furthermore, institutional and spatial factors such as government governance efficacy, regional coordination mechanisms, and geographical location collectively shape the vulnerability and recovery pathways of an urban economic system (Martin et al., 2016; Angulo, Mur and Trívez, 2018; Adger, 2003; Monastiriotis, 2015).

Although the aforementioned research has laid a solid foundation for both new quality productive forces and economic resilience respectively, cross-disciplinary studies between the two remain relatively weak. A significant gap lies in the scarcity of research on their correlation: existing literature discussing the economic effects of new quality productive forces mostly focuses on dimensions such as growth and transformation (Wang, Hou and Li, 2025; Li and Wang, 2024; Li and Yu, 2024; Chen and Wu, 2024), while few have systematically examined its direct impact as a core driving factor on the dynamic changes of urban economic resilience (Xu, Zhong and Dong, 2024). There is a lack of in-depth empirical exploration into the mechanism of how new quality productive forces empower cities to cope with external shocks and enhance systemic resilience. Another key shortcoming is the unclear mechanistic pathways: although some studies mention that new quality productive forces might indirectly affect resilience through channels like technological innovation and industrial upgrading (Wang, Hou and Li, 2025; Li and Wang, 2024), there is a lack of empirical analysis focusing on the specific, testable mediating pathways that are rooted in the distinctive characteristics of new quality productive forces and are directed towards resilience enhancement (Tian and Guo, 2023).

In light of this, this study aims to bridge the aforementioned research gaps. Its core innovations are as follows: Firstly, it pioneers the treatment of new quality productive forces as the core independent variable. Utilizing panel data from 284 prefecture-level cities across China from 2012 to 2022 and a two-way fixed effects model, it systematically and empirically tests the direct driving effect of new quality productive forces on urban economic resilience levels and its regional heterogeneity, thereby filling the gap in direct correlational empirical research. Secondly, it delves deeply into the mechanism through which new quality productive forces empower resilience, focusing on and empirically verifying three key transmission pathways: "digital technology innovation," "industrial agglomeration and upgrading," and "human capital enhancement." This clarifies how new quality productive forces

reshape the risk resistance, adaptation, and recovery capacities of urban economies through these dimensions, providing empirical support for the mechanistic pathways.

2. Theoretical Analysis and Research Hypotheses

2.1 Direct Impact of New Quality Productive Forces on Urban Economic Resilience

First, new quality productive forces accelerate the evolution of the labor structure towards digitalization and intellectualization (Shi and Xu, 2024). Emerging professions such as AI trainers and data engineers continue to emerge, significantly enhancing workers' ability to adapt to technological iterations. This high-quality labor force possesses strong capabilities in technology application and tool operation, which helps improve the flexibility and adjustment capacity of the economic system in response to technological shocks. Simultaneously, by attracting high-end human capital, new quality productive forces promote the formation of knowledge-intensive talent clusters within regions, strengthening regional capabilities in knowledge diffusion and technological innovation, thereby raising the stress tolerance threshold of the economic system. Furthermore, platform-based and flexible employment models are becoming increasingly prevalent. Non-traditional forms of employment such as the sharing economy and remote collaboration broaden employment channels. Workers can leverage digital platforms to trade skills and realize value conversion, thereby mitigating structural unemployment risks and enhancing the economic system's adaptability to cyclical fluctuations through more flexible labor resource allocation.

Second, new quality productive forces drive the transformation of the production factor structure from primarily relying on natural resources towards expanding to include new energy, new materials, as well as new-type elements like data and information. The application of new energy and new materials not only drives a new round of industrial growth but also enhances enterprises' flexibility in responding to market changes. The introduction of data elements enables enterprises to dynamically adjust production and supply chain layouts based on real-time information, thereby increasing the resilience and responsiveness of production processes. Meanwhile, new quality productive forces emphasize the synergistic development of traditional and emerging industries. Through technological innovation and knowledge spillover effects, they promote the optimal regional layout of industrial chains, driving the industrial system towards greening and intensification. Particularly with the support of new energy and circular material technologies, cities possess greater adaptive capacity when facing environmental regulations, contributing to the dual enhancement of industrial structure transformation and sustainable development capabilities.

Third, new quality productive forces guide the upgrading of means of labor towards intellectualization and greening in their functional attributes (Wu, 2024). The introduction of smart manufacturing equipment enhances the automation level of

production systems, reduces human operational errors, improves overall production efficiency, and to some extent alleviates structural constraints caused by labor shortages. Meanwhile, green technologies, through the promotion of clean energy and the recycling of emissions, effectively reduce the negative environmental impact of production activities and enhance urban economic stability under environmental policy pressures. Furthermore, digital management systems enable resource scheduling and system simulation optimization based on real-time data, building a supply chain system capable of resilient response. This process forms a dynamic closed-loop mechanism of "efficiency enhancement - risk mitigation - resilience strengthening," providing technical support and structural assurance for the resilience of the urban economic system.

H1：An enhancement in the level of new quality productive forces can strengthen urban economic resilience.

2.2 Indirect Impact of New Quality Productive Forces on Urban Economic Resilience

2.2.1 Digital Technology Innovation Effect

Digital technology innovation significantly enhances urban economic resilience, as its role embodies continuously injecting innovative vitality into urban economic development and improving the city's resistance, recovery capacity, and sustained growth capability in the face of external shocks (Zhang and Yao, 2023). By optimizing the urban digital governance system, digital technology innovation can enhance the city's adaptability to shocks, allowing it to anticipate impacts in advance and take preventive measures, thereby mitigating damage and promoting recovery and growth. Digital technology innovation helps cities optimize resource allocation, explore new growth opportunities, maintain stability after external shocks, and adjust quickly, thus enhancing economic resilience. Furthermore, digital technology innovation promotes industrial structure upgrading. Through digital transformation and the formation of innovation ecosystems, it strengthens inter-industry linkages and information transmission, disperses risks, and facilitates economic recovery. On the other hand, digital technology innovation also improves total factor productivity, reduces transaction costs caused by information asymmetry, promotes factor mobility and enhances resource allocation efficiency, thereby strengthening the resilience of the urban economy (Liu, Zhang and Li, 2021). Simultaneously, it reduces operational costs for enterprises, improves enterprise efficiency, stimulates innovation and entrepreneurial activity, further enhancing economic resilience.

New quality productive forces provide a favorable institutional environment and efficient resource allocation for digital technology innovation, promoting market-oriented reforms in production factors and optimizing the structure of resource allocation. By strengthening the interconnections among factors, new quality productive forces create a conducive environment for their free flow, thereby

offering more efficient resource support for digital technology innovation (Cai and He, 2024). Simultaneously, new quality productive forces guide the flow of labor, capital, and technology toward high value-added sectors, optimize factor inputs in production processes, and drive the rationalization of the industrial structure. These changes reduce resource misallocation and market distortions, laying a solid industrial and institutional foundation for digital technology innovation, which in turn fosters innovative development and enhances economic sustainability. In this process, digital technology innovation serves as a mediating variable, playing a key role in linking new quality productive forces to the enhancement of economic resilience.

H2a: New quality productive forces enhance urban economic resilience by boosting digital technology innovation.

2.2.2 Industrial Agglomeration Effect

Industrial agglomeration plays a significant role in enhancing economic resilience, particularly in improving a city's ability to withstand shocks and strengthening its economic recovery capacity (Chen, 2022). By sharing infrastructure and public services, industrial agglomeration enables enterprises to reduce operational costs and improve production efficiency (Ding, 2023). In manufacturing agglomeration areas, well-developed transportation networks and logistics facilities ensure the timely supply of raw materials and the rapid distribution of products, allowing cities to quickly allocate resources in the face of external shocks and maintain stable production activities. Furthermore, the economies of scale brought by industrial agglomeration help enterprises maintain market share during economic downturns by reducing costs, thereby sustaining urban employment levels and economic stability. Meanwhile, industrial agglomeration fosters synergistic innovation among industries, and collaboration between enterprises accelerates the development and application of new technologies, thereby assisting cities in achieving rapid recovery and transformation after economic shocks (Xu and Zhang, 2019).

New quality productive forces promote industrial agglomeration by accelerating market-oriented reforms of production factors and facilitating the free flow of these factors. Through the application of digital technologies, production factors such as labor and capital can be precisely allocated to flow into high value-added industrial agglomeration areas, thereby enhancing resource allocation efficiency. New quality productive forces reduce market transaction costs and information asymmetry, enabling capital to flow more efficiently into industrial agglomeration areas and driving agglomeration development. Meanwhile, technological innovation and improvements in production efficiency allow enterprises within industrial agglomeration areas to attract more related industries, forming industrial clusters and enhancing the competitiveness of the agglomeration zones. New quality productive forces promote the optimization and upgrading of the industrial structure, providing broader development space for agglomeration areas, attracting numerous

enterprises to cluster around emerging industries, and thereby fostering sustainable regional economic development.

H2b：New quality productive forces enhance urban economic resilience by promoting industrial agglomeration.

2.2.3 Human Resource Level Enhancement Effect

New quality productive forces continuously enhance the level of human capital through multidimensional mechanisms. Firstly, the development of new quality productive forces prompts the industrial structure to continuously upgrade towards high-value-added and high-technology sectors, thereby increasing the demand for high-quality talent in the labor market and driving the optimization of urban education systems and the improvement of vocational training systems (Zhang and Gan, 2025). Driven by emerging industries such as the digital economy, new energy, and high-end manufacturing, cities have accelerated the development of matching academic disciplines and specialties, prompting universities and vocational institutions to continuously adjust their program offerings, strengthen the cultivation of innovative talent and versatile technical workers, and expand the supply of high-quality human capital. Secondly, while fostering a favorable innovation ecosystem, new quality productive forces enhance the city's attractiveness to high-end talent. Through institutional innovation, platform development, and policy incentives, they attract talent aggregation and improve their employment quality and development prospects within the city, thereby facilitating the transformation of demographic dividends into talent dividends.

The accumulation of human capital forms the foundation for building resilience in urban economic systems. A higher level of human capital leads to a more advanced labor structure, making it easier to form a pool of innovative factors during population agglomeration, thereby enhancing the city's production efficiency and innovation capacity and strengthening its economic adaptability and recovery capabilities. High-quality human capital can effectively integrate with factors such as capital and land, optimizing factor allocation and improving overall resource utilization efficiency. This positive externality equips cities with stronger adjustment and restructuring capabilities when facing external shocks. Highly skilled workers not only possess greater employment stability and adaptability themselves but also drive improvements among low-skilled laborers through skill spillover and learning mechanisms, thereby enhancing the overall risk resistance and recovery speed of the labor market (Wu, Song and Chen, 2024).

H2c：New quality productive forces enhance urban economic resilience by elevating the level of human capital.

3. Research Design

3.1 Sample Selection and Data

This paper selects 284 prefecture-level and above cities from 2012 to 2022 as samples and employs a two-way fixed effects model to thoroughly examine the impact of China's new quality productive forces on urban economic resilience. The data primarily come from the *China City Statistical Yearbook*, *China Energy Statistical Yearbook*, *China Environment Statistical Yearbook*, *China Statistical Yearbook on Science and Technology*, China Statistical Database, and the Chinese Research Data Services Platform (CNRDS). Missing values in some samples were supplemented using local statistical yearbooks, statistical bulletins, or the linear interpolation method.

3.2 Variable Selection and Processing

3.2.1 Dependent variable: Economic Resilience (ER)

Currently, there is no consensus in the academic community on the measurement method for economic resilience. Since the core explanatory variable in this paper is measured using a comprehensive indicator system, to avoid the complexity of interrelationships among too many indicators, a single indicator is adopted to measure regional economic resilience. Following the research approach of Martin and Sunley (2015), this paper uses the sensitivity indicator of per capita gross regional product to measure regional economic resilience and applies a centering transformation to it. This indicator not only reflects the capacity of a regional economy to withstand adverse shocks but also reveals its specific performance characteristics during the recovery phase. A larger value of this indicator indicates a higher level of urban economic resilience.

$$R_{i,t} = \frac{\Delta Y_{i,t} - \Delta C_{i,t}}{|\Delta C_{i,t}|} = \frac{\frac{Y_{i,t}-Y_{i,t-1}}{Y_{i,t-1}} - \frac{C_{i,t}-C_{i,t-1}}{C_{i,t-1}}}{\left|\frac{C_{i,t}-C_{i,t-1}}{C_{i,t-1}}\right|} \quad (1)$$

Here, i denotes a specific city, t denotes the year, $R_{i,t}$ represents urban economic resilience, $\Delta Y_{i,t}$ is the change in the regional GDP per capita of city i, measuring the change in urban economic output, and $\Delta C_{i,t}$ is the change rate of national GDP per capita in year t, representing the expected output change.

3.2.2 Explanatory variable: New Quality Productivity (NQP)

Drawing on the approaches of Wang and Wang (2024) and Han (2024), an evaluation indicator system for the development level of new quality productive forces was constructed, and the entropy method was used to calculate the new quality productive forces development index. The specific calculation indicators are shown in Table 1.

Table 1: Indicator System for New Quality Productivity

Criterion Layer	Primary Indicator	Secondary Indicator	Item	Measure	Attribute
Labor Force	Labor Productivity	Economic Output	Per capita GDP	GDP / total population	+
		Economic Income	Average Wage	Average wage of employees in post	+
		Employment Structure	Share of employment in tertiary industry	Tertiary employment / total employment	+
	Workforce Quality	Educational Attainment	Higher Education Level	Number of regular higher education institutions	+
		Knowledge Accumulation Potential	Student Body Structure	Enrollment in regular higher education institutions	+
		Innovative Spirit	Input of innovative human resources	R&D full-time equivalent personnel	+
			Entrepreneurial Activity	Number of newly founded enterprises per 100 people	+
Objects of Labor	Future Development	Future Industries	Strategic emerging industries	Number of employees in strategic emerging industries	+
		Informatization Level	Robot installation density	Robots / total population	+
			Share of employment in computer services and software	Employees in computer services and software / total year-end employment	+
			Artificial intelligence technological innovation	Total AI patent grants	+
	Ecological Environment	Pollution Reduction	Industrial pollution control	Investment in environmental pollution control	+
			Municipal solid waste treatment	Harmless disposal rate of municipal solid waste	+
		Green Ecology	Scale of carbon trading	Volume of carbon trading, energy-use rights trading, and emission-rights trading	+
			Green resources	Green area in built-up districts	+
			Environmental protection intensity	Environmental protection expenditure / general public fiscal expenditure	+
Means of Labor	Technological Innovation	Input to technological innovation	Share of science expenditure in local fiscal spending	Science expenditure / local fiscal expenditure	+
		Output of technological innovation	Number of invention patent applications	Number of invention patent applications in the year	+
			Number of utility model patent applications	Number of utility model applications in the year	+
	Data Factors	Utilization of data factors	Level of data factor utilization	Level of data factor utilization	+
			Presence of data trading platform	Whether a data trading platform exists	+
	Greening	Energy use level	Energy intensity	Energy consumption / GDP	-
		Green technological innovation	Number of green invention patent applications	Number of green invention patents applied for that year	+
			Number of green utility model patent applications	Number of green utility model applications that year	+
	Infrastructure	Digital infrastructure	Internet penetration	Internet users per 100 people	+
			Mobile phone penetration	Mobile phone users per 100 people	+
			telecom business volume	Total telecom business volume	+
		Traditional Infrastructure	Highway mileage	Total highway mileage	+
			Road area	Road area per capita	+

3.2.3 Control variables

To minimize potential bias from omitted variables and better investigate the net effect of new quality productive forces on urban economic resilience, this paper controls for the following variables: (1) Economic development level (GDP): measured by the logarithm of GDP per capita; (2) Fiscal technology expenditure intensity (FTE): measured by the ratio of urban fiscal expenditure on science and technology to the general public budget; (3) Urban cultural soft power (BOOK): measured by the number of books collected per 10,000 people; (4) Level of openness to the outside world (OPEN): measured by the logarithm of foreign direct investment; (5) Financial development efficiency (FEF): measured by the ratio of the year-end balance of financial institution deposits and loans to GDP.

3.2.4 Mediating variable

Drawing on Sun Yong et al. (2022), this paper measures digital technology from the perspective of R&D output by selecting the number of related patents. Since the number of patent applications in relevant fields can reflect the direction of technological development in an industry, we use the logarithm of the number of patent applications in digital-economy industries to measure the level of digital technological innovation (DI).

According to the Statistical Classification of the Digital Economy and Its Core Industries (2021), we define the scope of the digital economy and its core industries, covering five major categories and 156 subdivided subcategories, including computer, communication and other electronic equipment manufacturing; telecommunications, broadcasting, television and satellite transmission services; and internet and related services. We then determine the International Patent Classification (IPC) codes for each industry by referring to the Concordance Table between the International Patent Classification and the National Economy Industry Classification (2018) based on the corresponding national industry codes and names. Finally, we retrieve the patent classification codes in the national intellectual property patent database to obtain the number of digital-economy patent applications for 284 cities nationwide from 2012 to 2022.

Following Yang (2013), we use location entropy to measure the level of urban industrial agglomeration (IA). Following Chen and Guo (2024), we use the number of college students in school per 10,000 people to reflect the level of human capital.

3.3 Model Construction

3.3.1 Descriptive Statistics

Table 2: Descriptive Statistics

Variable Type	Variable Name	N	Mean	SD	Min	Max
Dependent Variable	ER	3124	0.125	0.519	-0.284	1.499
Explanatory Variable	NQP	3124	0. 0526	0.075	0.004	0.364
Mediating Variable	DI	3124	5.582	1.805	0	11.457
	IA	3124	0.101	0.152	0.056	0.546
	HUM	3124	10.684	1.210	8.590	13.158
Control Variable	GDP	3124	10.784	0.651	9.583	12.233
	FTE	3124	0.017	0.016	0.001	0.085
	BOOK	3124	0.715	0.811	0.081	5.245
	OPEN	3124	5.361	1.892	1.054	8.699
	FEF	3124	1.083	0.545	0.429	2.676

3.3.2 Baseline Regression Model

$$RES_{i,t} = \alpha_0 + \alpha_1 NQP_{i,t} + \alpha_x control_{i,t} + + \mu_i + \varphi_t + \varepsilon_{i,t} \quad (2)$$

The above is the baseline regression model specified in this paper, where $RES_{i,t}$ denotes the level of economic resilience of region i in year t; $NQP_{i,t}$ is the indicator of new-quality productive forces; and $control_{i,t}$ is a set of control variables, including the level of economic development, the intensity of fiscal expenditure on science and technology, urban cultural soft power, the degree of openness, and the efficiency of financial development. μ represents city fixed effects, φ represents year fixed effects, and $\varepsilon_{i,t}$ is the random disturbance term. This model is used to test whether new-quality productive forces have a significant impact on regional economic resilience and to provide foundational support for the subsequent mechanism analysis.

3.3.3 Mediation Effect Model

In the theoretical analysis, it is proposed that digital technology innovation, industrial agglomeration, and improvements in human capital—induced by new-quality productive forces—are important mechanisms for enhancing urban economic resilience. Following the mechanism-testing approach proposed by Jiang Ting(2022), this paper constructs the following mechanism test model to examine the mediating mechanisms:

$$M_{i,t} = \alpha_0 + \alpha_1 NQP_{i,t} + \alpha_x control_{i,t} + + \mu_i + \varphi_t + \varepsilon_{i,t} \quad (3)$$

In the equation, $M_{i,t}$ denotes the mechanism variable, and the meanings of the remaining variables are consistent with those in the baseline regression model.

4. Empirical Findings and Analysis

4.1 Baseline Regression Analysis

The table presents the baseline regression results for the impact of new-quality productive forces on urban economic resilience. Column (1) considers only year and city fixed effects, and the results show that the estimated coefficient of new-quality productive forces is positive at the 1% significance level. Columns (2) through (6) sequentially introduce different groups of control variables—including the level of economic development, the intensity of fiscal expenditure on science and technology, urban cultural soft power, the degree of openness, and the efficiency of financial development—to test the robustness of the results. It can be seen that the coefficient of new-quality productive forces remains positive across all models and is significant at the 1% level, with estimated values ranging from 0.130 to 0.227. The magnitudes are stable and the significance is robust, indicating that new-quality productive forces have a stable and significant promoting effect on urban economic resilience. This result is consistent with the theoretical expectations, and H1 is confirmed.

Table 3: Benchmark Regression Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)
NQP	0.227***	0.160***	0.137***	0.137***	0.130**	0.135***
	(4.63)	(3.26)	(2.72)	(2.72)	(2.51)	(2.61)
GDP		0.409***	0.385***	0.377***	0.353***	0.226***
		（8.58)	（7.81)	(7.55)	(6.81)	(3.92)
FTE			0.040**	0.041**	0.036*	0.035*
			(2.00)	(2.01)	(1.73)	(1.72)
BOOK				0.024	0.027	0.052*
				(0.95)	(1.02)	(1.93)
OPEN					0.008**	0.007*
					(2.03)	(1.86)
FEF						-0.274***
						(-4.87)
Individual Fe	Y	Y	Y	Y	Y	Y
Year Fe	Y	Y	Y	Y	Y	Y
Constant	1.285***	-3.276***	-2.921***	-2.823***	-2.653***	-1.370**
	(6.64)	(-5.81)	(-4.97)	(-4.71)	(-4.25)	(-2.03)
N	3124	3124	3124	3124	3124	3124
R^2	0. 1203	0.1430	0.1443	0.1446	0.1495	0.1875

4.2 Endogeneity Test

In the baseline regression analysis, there may be variables that affect new-quality productive forces as well as variables that affect urban economic resilience, thereby giving rise to endogeneity. Accordingly, we use the one-period lag of new-quality productive forces as an instrumental variable and estimate the model via 2SLS. As shown in Table 4, the p-value of the LM statistic is less than 0.01 and the Wald statistic exceeds the critical value of 16.38, indicating rejection of the null hypotheses of underidentification and weak identification and suggesting that the chosen instrument is appropriate. The estimated coefficient of new-quality productive forces is 0.303 and passes the 1% significance test, indicating that after introducing the instrumental variable, new-quality productive forces still significantly promote urban economic resilience, consistent with the baseline regression results. After bringing the endogeneity issue into the scope of the analysis, the effect of new-quality productive forces on urban economic resilience remains significantly positive. This demonstrates that the above regression results are highly persuasive and explanatory.

Table 4: Endogeneity Test Results

Variables	Endogeneity Test	
	(1)	(2)
NQP		0.303**
		(2.01)
IV	0.415***	
	(8.39)	
Constants	Y	Y
Individual Fe	Y	Y
Year Fe	Y	Y
K-P F	70.31	
	{16.380}	
K-P LM	89.19	
	[0.000]	

4.3 Robustness checks

To further verify the robustness of the core conclusions, this paper conducts robustness checks from the following four aspects: (1) selecting a subset of the sample. To eliminate the bias in the baseline results caused by noise from the COVID-19 pandemic, the sample period is shortened to 2019 for re-estimation; (2) excluding municipalities directly under the central government. In view of the unique locational advantages and regional characteristics of municipalities, Beijing, Tianjin, Shanghai, and Chongqing are excluded; (3) replacing the dependent variable. Following existing studies, the dependent variable is replaced with the unemployment rate(UR) (Cheng and Jin, 2022). Employment stability is a core

manifestation of economic resilience, and the unemployment rate reflects a city's capacity to withstand shocks and recover from the perspective of the labor market; therefore, it is highly substitutable for economic resilience. The regression results show that the coefficient of the core explanatory variable is significantly negative, indicating that new-quality productive forces can effectively reduce the unemployment rate; (4) excluding extreme values in the sample. Considering that the data for relevant variables may contain outliers that could affect the regression results, the selected variables are winsorized at the 1% upper and lower tails and re-estimated, after which the data for each variable are substituted into the model again for verification.

As shown in Table 5, after these procedures, the estimated coefficient of new-quality productive forces remains significantly positive, indicating that the empirical results exhibit a certain degree of robustness.

Table 5: Robustness Test Results

Variables	(1)	(2)	(3)	(4)
	ER	ER	UR	ER
NQP	0.238**	0.126**	-0.027**	0.130***
	(2.53)	(2.41)	(-1.74)	(2.73)
Constants	-3.636***	-1.275*	2.216***	-1.219*
	(-3.92)	(-1.87)	(11.58)	(-1,95)
Control	Y	Y	Y	Y
Individual Fe	Y	Y	Y	Y
Year Fe	Y	Y	Y	Y
N	2272	3124	3124	3124
R^2	0.2176	0.1578	0.1699	0.1761

5. Further analysis

5.1 Heterogeneity Analysis

5.1.1 Level of technological investment

The level of science and technology (S&T) investment reflects the extent to which governments prioritize urban technological innovation. Cities with higher S&T investment often exhibit higher production efficiency and innovative vitality. Therefore, it is necessary to examine whether differences in government S&T investment lead to heterogeneous effects of new-quality productive forces on urban economic resilience. This paper measures the level of urban S&T expenditure by the share of S&T spending in the government's general public budget and, using the median as the cutoff, divides the sample into two groups—high S&T investment and low S&T investment—for testing. The test results are reported in columns (1) and (2) of Table 6. In environments where S&T resources are relatively scarce, new-quality productive forces that promote the optimization of production factors and the upgrading of industrial structure play a more crucial role in strengthening urban

economic resilience. This mainly follows the law of diminishing marginal returns: in low-investment regions, new-quality productive forces can more efficiently remedy S&T shortcomings, correct resource misallocation, and rapidly absorb technologies, making their marginal contribution particularly salient; whereas in high-investment regions, where the S&T base is relatively well developed, new-quality productive forces must operate at higher levels—targeting frontier innovations with greater uncertainty or pushing efficiency toward its limits—so their short-term marginal benefits are relatively weaker and may be statistically insignificant. This also implies that in areas where S&T investment has not yet been fully extended, the marginal contribution of new-quality productive forces is more pronounced.

5.1.2 Geographical Location

To further investigate the differential impact of new quality productive forces on urban economic resilience against the backdrop of regional development imbalances, this study divides the national sample into two groups—cities on the eastern side and cities on the western side of the Hu Line—for separate grouped regression analysis. As a crucial geographical demarcation measuring China's imbalances in population, resources, and development, the Hu Line reveals significant heterogeneity in aspects such as urban-rural structure, industrial foundation, and policy support. The results in columns (3) and (4) of Table 6 show that the coefficient of new quality productive forces is significantly positive and passes the test at the 1% level for cities on the eastern side, whereas it is not significant for cities on the western side. This indicates that the enhancing effect of new quality productive forces on economic resilience is more pronounced in the eastern region. The possible reasons lie in the fact that cities on the eastern side possess more developed market mechanisms, higher levels of talent agglomeration, and more mature industrial structures, enabling the factor recombination and technological innovation brought by new quality productive forces to be more efficiently translated into shock resistance and recovery capacity.

5.1.3 Resource endowment

Urban resource endowment affects industrial agglomeration, industrial structure upgrading, and environmental pollution levels. Drawing on the research of Wang Li et al., this study categorizes cities into resource-based and non-resource-based groups according to the "National Sustainable Development Plan for Resource-based Cities (2013-2020)" issued by the State Council on November 12, 2013, for testing (Wang, Li and Dong, 2023). The test results are shown in columns (5) and (6) of Table 6 below. In resource-based cities, the regression coefficient for new quality productive forces is 0.206, significant at the 1% level, whereas in non-resource-based cities, the coefficient is 0.101, also significant but with a relatively lower magnitude of effect. This result indicates that the promoting effect of new quality productive forces on economic resilience is stronger in resource-based cities.

On the one hand, resource-based cities have long faced issues such as the "resource curse" and a singular industrial structure. The introduction of new quality productive forces helps shift traditional resource-dependent industries towards high-value-added, low-carbon directions, thereby enhancing their adaptability and recovery capacity when facing external shocks. On the other hand, the factor restructuring, technological innovation, and institutional optimization driven by new quality productive forces provide greater space and momentum for structural adjustment in resource-based regions, compensating for shortcomings in their original development models. In contrast, non-resource-based cities have relatively diversified industrial structures and more adequate infrastructure and human capital reserves, meaning their economic resilience already has a certain foundation; thus, the marginal impact of new quality productive forces is relatively limited.

Table 6: Heterogeneity analysis results

Variables	S&T		Hu Line	Res. End		
	Low	High	Western	Eastern	Non-res.-based	Res.-based
NQP	0.216***	0.075	-0.228	0.173***	0.101*	0.206**
	(2.64)	(1.09)	(-0.50)	(2.98)	(1.65)	(2.26)
GDP	0.333***	0.234***	-0.355	0.226***	0.320***	0.076
	(3.21)	(3.41)	(-0.47)	(3.63)	(4.75)	(1.32)
FTE	0.032	-0.030	0.333	0.042*	0.046*	0.062*
	(0.80)	(-0.79)	(1.23)	(1.90)	(1.92)	(1.72)
BOOK	0.042	0.066**	0.034	0.029	0.041	0.063
	(0.88)	(2.04)	(0.14)	(0.310)	(1.50)	(0.91)
OPEN	0.011*	0.005	-0.086**	0.007	0.007*	0.008
	(1.60)	(1.13)	(0.039)	(1.90)	(1.76)	(1.09)
FEF	-0.258***	-0.208**	-0.281	-0.165**	-0.179**	-0.398***
	(-2.83)	(-2.53)	(-0.40)	(-2.32)	(-2.53)	(-3.99)
Individual Fe	Y	Y	Y	Y	Y	Y
Year Fe	Y	Y	Y	Y	Y	Y
Constants	-2.007*	-2.018**	5.401	-1.268*	-2.484***	0.661
	(-1.69)	(-2.50)	(0.68)	(-1.74)	(-3.15)	(0.54)
N	3124	1376	90	2034	1869	1255
R2	0. 1403	0.2117	02547	0.2002	0.1994	0.1753

5.2 Mediation Effect Test

Table 7 reports the mechanism test results, where columns (1), (2), and (3) correspond to the digital technology innovation effect, industrial agglomeration effect, and human capital enhancement effect, respectively. The results in column (1) show that the core explanatory variable is significantly positive, indicating that new quality productive forces have a significant positive impact on the level of digital technology innovation. This suggests that new quality productive forces provide a technological foundation and responsive capacity support for enhancing the resilience of the urban economic system by accelerating the research, development, and application of digital technologies and optimizing the efficiency of factor allocation, thus validating H2a. The results in column (2) show that new quality productive forces also positively influence the level of industrial agglomeration, indicating that by promoting the free flow of factors and the formation of high-value-added industrial clusters, they optimize the regional industrial structure, thereby enhancing the city's ability to coordinate resources and recover quickly when facing external shocks, thus validating H2b. The results in column (3) show that new quality productive forces can elevate the urban human capital level, indicating that they promote the aggregation and cultivation of high-level talent in cities. With the continuous increase in the higher education penetration rate and the proportion of scientific research talent, the overall human capital structure of cities tends to optimize, providing strong support for the development of new technologies, industries, and business models and effectively enhancing urban economic resilience, thus validating H2c.

Table 7: Mechanism regression results

Variables	(1)	(2)	(3)
	DI	IA	HUM
NQP	0.246***	0.260***	0.325**
	(5.29)	(3.01)	(1.97)
Control	Y	Y	Y
Constants	2.799***	-12.086***	0.334
	(4.64)	(-10.81)	(0.16)
Individual Fe	Y	Y	Y
Year Fe	Y	Y	Y
N	3124	3124	3124
R^2	0.7546	0.4890	0.3220

6. Conclusion and Policy Implications

Based on data for 284 prefecture-level cities and above in China from 2012 to 2022, this paper examines the specific impact of new-quality productive forces on urban economic resilience. The study finds that new-quality productive forces have a significant promoting effect on urban economic resilience, with digital technology innovation, industrial agglomeration, and improvements in human capital playing mediating roles. The heterogeneity analysis shows that the enhancing effect of new-quality productive forces on urban economic resilience is more pronounced in cities with lower levels of S&T investment; in resource-scarce environments, new-quality productive forces exhibit higher marginal effects in boosting resilience. In cities east of the Hu Huanyong Line, the driving role of new-quality productive forces is more prominent, indicating a higher degree of reliance on mechanisms of factor agglomeration and structural optimization; and in resource-based cities, the coefficient is larger and more significant, suggesting that new-quality productive forces are particularly critical in promoting industrial transformation and enhancing the capacity to withstand shocks. These results indicate that regional characteristics, factor endowments, and policy foundations significantly influence the pathways through which new-quality productive forces operate. Based on the above results, this paper proposes the following recommendations:

First, systematically strengthen the foundations for cultivating new-quality productive forces and comprehensively enhance the support capacity for urban resilience. The government should continuously reinforce the cultivation and release of new-quality productive forces nationwide. Increase fiscal support for scientific and technological R&D, establish dedicated research funds for key areas such as digital technologies, high-end equipment manufacturing, and new energy, and support the coordinated advancement of basic and applied research. Local governments should, in light of their industrial base and comparative advantages, scientifically plan the industrial layout of new-quality productive forces, with a focus on building industrial clusters in electronic information, new energy, and biomedicine, strengthening infrastructure in parks such as transportation, communications, and energy, and improving service support capacity. From the perspective of institutional supply, the government should foster a sound innovation ecosystem, promote the coordinated evolution of science and technology, industry, and institutions, and enhance the urban economic system's capacity for resistance, recovery, and transformation when facing external shocks.

Second, attach great importance to the mediating role of human capital between new-quality productive forces and urban economic resilience. Increase investment in education, optimize curricula, and add majors related to new-quality productive forces, such as big data and robotics engineering. Strengthen faculty development, attract and cultivate teachers with innovative spirit and practical ability, and improve educational quality. Establish and refine talent introduction policies, providing measures such as housing subsidies, preferential schooling for children, and start-up research funds for high-end talent and innovative teams in fields related

to new-quality productive forces. At the same time, strengthen the talent training system, carry out new skills training for on-the-job employees, and improve workers' quality and their ability to adapt to the development of new-quality productive forces. By improving the education system, perfecting talent incentives and introduction mechanisms, and optimizing the structure of vocational training, accelerate the cultivation of a high-quality workforce suited to digital and green development, thereby providing solid human resources support for the effective implementation of new-quality productive forces and the sustained enhancement of urban resilience.

Third, formulate differentiated strategies based on regional endowment differences. In areas with lower levels of S&T investment, increase fiscal S&T input and public R&D support, improve innovation incubation platforms and technology transfer mechanisms, and enhance the capacity of regions with weak S&T resources to absorb and transform new-quality productive forces. In cities east of the Hu Huanyong Line, further leverage advantages in industrial agglomeration and the digital economy, promote the orderly clustering of high-quality factors, and accelerate the establishment of regional innovation core areas; whereas in the western and resource-based cities, rely on new-quality productive forces to drive the upgrading of traditional industries and the green, low-carbon transition, strengthen factor reconfiguration capacity, and increase policy support for digital infrastructure, intelligent industrial transformation, and talent cultivation and attraction, thereby enhancing their capacity for self-repair and structural adjustment under external shocks. Accelerate the establishment of interregional linkage mechanisms, emphasize cross-regional technology spillovers and policy coordination in the cultivation of new-quality productive forces, narrow the development gap between the two sides of the Hu Huanyong Line, and build a multi-level, coordinated pathway for enhancing resilience.

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