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Research on the Impact of Smart City Construction on New Quality Productivity - A Quasi-Natural Experiment Based on the "Smart City" Strategic Pilot

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Abstract : Based on the panel data of 287 prefecture-level cities from 2011 to 2022, this article takes "smart city construction" as a quasi-natural experiment and uses the difference-in-differences model to analyze the impact of smart city construction on new quality productivity. Benchmark analysis indicates that the construction of smart cities has a significant positive impact on new quality productivity. Mechanism analysis indicates that both the level of human capital and the level of science and technology play a mediating role in the impact of smart city construction on new quality productivity. In the heterogeneity test, in terms of urban location heterogeneity, the construction of smart cities in the eastern and western regions has a significant promoting effect on new quality productivity. The significance in the western region is greater than that in the eastern region, while it is not significant in the central region. In the heterogeneity of urban scale, the influence coefficient of large cities is negative and not significant. In medium and small-sized cities, the construction of smart cities has a promoting effect on new quality productivity. The threshold effect indicates that there is a threshold effect in the upgrading of industrial structure. The stronger the level of industrial structure upgrading, the stronger the promoting effect of smart city construction on new quality productive forces. Therefore, it is proposed to promote the construction of new infrastructure related to smart cities, take human capital and scientific and technological levels as important means to enhance the quality of productivity, promote the regional coordinated construction of smart cities, and provide differentiated policy support to regions and industries at different stages of industrial structure upgrading.

Keywords: Smart city construction; New Quality productivity; The level of science and technology; Human capital level Upgrading of industrial structure

1. Introduction

New quality productivity is a new economic concept proposed by China based on the characteristics of the economic development era [1]. The Outline, released in March 2021, for the first time proposed at the national strategic level to "accelerate digital development and create new advantages in the digital economy", emphasizing the cultivation of new forms of productive forces through technological innovation and institutional reform. In December of the same year, The State Council issued the "14th Five-Year Plan for the Development of the Digital Economy", further clarifying that "data should be the key element to promote the deep integration of digital technology and the real economy", providing a policy interpretation for the connotation of new quality productive forces. In academic research, scholars such as Hong Yinxing systematically expounded the theoretical framework of new quality productivity in Economic Research Journal, pointing out that its essence is "a productivity leap that reconstructs the factor allocation and industrial collaboration model with digital technology as the core driving force" [2]. It is evident that the proposal and deepening of new quality productivity is not only an active response from the policy level to global technological competition and domestic transformation and upgrading, but also a contemporary expansion of traditional productivity theories by the academic community.

As a practical carrier of the deep integration of digital technology and urban governance, smart cities are an important breakthrough for cultivating new quality productive forces. From 2012 to 2014, the Ministry of Housing and Urban-Rural Development established three batches of national smart city pilot projects, covering 277 regions across the country, aiming to optimize resource allocation and industrial collaboration efficiency through technological innovation. The first batch of pilot projects (in 2012) focused on infrastructure layout. Taking Wuxi City as an example, it built the country's first full-coverage Internet of Things perception network, with the access rate of the public data platform reaching 85%, and reduced the cost of digital transformation in the manufacturing industry by 22%. In the second batch of pilot projects (2013), the efficiency of public services was enhanced. Foshan City reduced the administrative approval time limit by 58% through the "one-stop" government affairs system, and the citizen satisfaction rate increased to 91%. Zhengzhou City's intelligent transportation system reduced the congestion index during peak hours by 17%. The third batch of pilot projects (in 2014) focused on the synergy between industry and ecology. Baoding City achieved a 13% reduction in energy consumption per unit of GDP and an average annual growth rate of 24% in the output value of the new energy industry by relying on the smart energy management platform. Sanya City optimized the efficiency of tourist diversion through the tourism big data center, and the carrying capacity of scenic spots increased by 28%[3]. Research shows that the construction of smart cities can reduce institutional transaction costs by 12% to 15% through the circulation of data elements and drive the average annual growth of total factor productivity by 0.3 to 0.5 percentage points [4].

Based on this, the article uses 287 prefecture-level cities across the country from 2011 to 2022 as panel data to empirically test the impact of smart city construction on new quality productivity, explore the influence mechanism of the two, and further analyze regional heterogeneity and threshold effects. The marginal contribution of this paper lies in the following: First, on the basis of improving the theory of smart city construction and new quality productivity, the differin-differences model is used to test the mediating effect between the level of science and technology and the level of human capital. Second, taking industrial structure upgrading as a threshold variable, the threshold effect between smart city construction and new quality productivity is studied. Thirdly, from the perspectives of regional heterogeneity and urban scale heterogeneity, study the effects of smart city construction on new quality productivity in different regions.

2. Literature Review

(1) Literature Review on the Concept of Smart City Construction

The construction of smart cities is the product of the deep integration of informatization and urbanization. Its core feature lies in relying on new-generation information technologies such as the Internet of Things, big data, cloud computing and artificial intelligence to promote the intelligent reconstruction of urban infrastructure, public services and industrial systems [5]. From a theoretical perspective, smart cities optimize the efficiency of urban resource allocation by building data-driven perception networks and intelligent decision-making systems, effectively promoting technological upgrading of traditional industries and the cultivation of knowledge-intensive emerging industries, and thereby forming a new type of economic growth momentum with technological innovation and the improvement of total factor productivity as its core [6]. At the practical level, this concept emphasizes inclusive social development, enhancing people's well-being through public services such as smart healthcare and education, and promoting sustainable urban development through the application of green technologies [7]. However, it should be noted that there is significant regional heterogeneity in the policy effect: the eastern region is more likely to achieve industrial upgrading by relying on its technological accumulation and resource endowment advantages, while the central and western regions are faced with the dual constraints of lagging technological penetration and insufficient matching of production factors [8].

Foreign scholars' research on smart cities presents a diverse perspective. Caprotti and Cowley(2019)[9] conducted a study on various cities in the UK and found that there are three ideas for smart city construction: The first one holds that the objects of smart city construction are special departments; The second view holds that the construction of smart cities is the organic integration of modern information technology and eco-cities. The third view holds that the construction of smart cities is the application of modern information technology to cities. Some scholars have also attempted to analyze the construction of smart cities from the perspectives of smart cities and human capital, urban management and public services. Giffinger et al. (2018) [10] hold that the core of smart city construction lies in integrating urban endowments with human capital: that is, providing citizens with the information the city possesses for them to make judgments and decisions, thereby exerting significant influences on urban economic growth, human capital, public services, and quality of life.

A comprehensive review of domestic and international research shows that a smart city is not merely a physical space transformation project empowered by technology, but also a systematic urban development model that integrates technological innovation, institutional innovation and governance innovation. The ultimate goal lies in achieving a balanced development of economic efficiency optimization, social equity improvement and ecological benefit enhancement through multi-dimensional collaborative innovation.

(2) Literature Review on New Quality Productivity

It is an advanced productive force state led by scientific and technological innovation, integrating features such as high technology, high efficiency and high quality. It emphasizes promoting industrial transformation and upgrading through innovation-driven development, getting rid of the traditional extensive development mode, and achieving sustainable and high-quality economic development. Although this concept was proposed relatively recently, it has already drawn extensive attention and discussion from the academic community. Gao Fan (2023) [11] holds that new quality productivity, as a transitional form of the integration of industrialization and informatization, reconstructs the productivity system through the integration of data elements, the improvement of total factor productivity, the cultivation of strategic emerging industries, and the government-market collaborative mechanism. Zhou Wen and Xu Lingyun (2023) [12] focused on the core position of disruptive technological breakthroughs, pointing out that they are driven by cutting-edge technologies such as artificial intelligence and rely on intellectual labor, high-precision and advanced equipment, and new production relations to achieve generational changes in productivity. Both reveal that the essence of new quality productive forces is the systematic upgrading of factors - technology - industry - system under the leadership of scientific and technological innovation.

In terms of the construction of the indicator system for new quality productive forces, the existing literature mainly conducts multi-dimensional indicator exploration based on the theoretical framework of the three elements of productive forces in Marxism. For instance, Lu Jiang et al. (2024) [13] constructed a comprehensive evaluation system integrating science and technology, green, and digital productivity, and adopted the improved entropy weight-TOPSIS method to reveal regional heterogeneity; Han Wenlong et al. (2024) [14] introduced a dual dimension of physical and penetrating elements, covering multiple indicators such as new types of workers, intelligent labor tools, and data elements, and verified its spatial spillover effect through the spatial Durbin model. Wang Jue (2024) [15] proposed the "1-2-3-4" theoretical framework, emphasizing the core position of scientific and technological innovation and the optimization of human capital structure. Its indicator system highlights the proportion of strategic emerging industries and the level of digitalization. Methodologically, entropy method, Dagum Gini coefficient and spatial convergence model have become mainstream tools. Sun Liwei et al. (2024) [16] further identified the transformation of technology and the upgrading of industrial structure as key constraints through the obstacle factor model. At present, existing research shows two major trends: one is the differentiated construction of indicators from a single economic field to multiple industries, and the other is the strengthening of spatial measurement methods to capture the regional linkage characteristics of new quality productivity. This provides a methodological basis for the spatial analysis of the impact effects of smart cities.

(3) Literature Review on the Impact of Smart City Construction on New Quality Productivity

In recent years, scholars at home and abroad have been conducting an increasing number of studies on smart city construction and new quality productivity. However, no research has been found so far to explore the correlation between smart city construction and new quality productivity. As the new quality productivity emphasizes the core features of "greenness, digitalization and innovation-driven", the construction of smart cities can be explored in these three aspects.

At the level of green development, the construction of smart cities has significantly promoted the low-carbon transformation of cities through the innovation of environmental governance models and the spillover effects of green technologies. Wei Lin and Ma Mengru (2022) [17] conducted an empirical study based on listed manufacturing companies, which demonstrated that smart city pilot projects have significantly increased the quantity and quality of green invention patents by optimizing the quality of internal control within enterprises and alleviating financing constraints. The mechanism of action is reflected in the enhanced environmental supervision efficiency and the optimal allocation of green innovation resources empowered by digital technology. Song Deyong et al. (2021) [18] further verified from the urban level the "simultaneous increase in quantity and quality" effect of smart city pilot projects on green technological innovation, and found that the information support effect and scale agglomeration effect were the main transmission paths, especially in the fields of alternative energy and transportation emission reduction, the incentive effect of technological innovation was significant.

In terms of digital transformation, the construction of smart cities has reshaped the economic operation paradigm of cities by building digital infrastructure and governance platforms. Xie Xiaoqin and Ren Shihui (2022) [19], taking the construction of a smart city in Chengdu as an example, revealed the integration efficiency of data elements under the "platform as government" model, and pointed out that digital scene applications such as e-government platforms and smart transportation systems have formed a new governance ecosystem of "overall intelligent governance" by enhancing governance perception and response speed. Hui Xianbo's (2023) [20] research further expanded the economic and social benefits of digital transformation. It was found that smart cities promote the digital reorganization of production factors by stimulating entrepreneurial activity. The new business forms such as e-commerce platforms and the sharing economy they give rise to have significantly improved the efficiency of resource allocation and provided digital impetus for the realization of the goal of common prosperity.

In the dimension of innovation-driven development, the construction of smart cities, through the reconstruction of the technological innovation ecosystem, has become the core engine for cultivating new quality productive forces. Wang Jie et al. (2024) [21] further revealed the dual mechanism of the effect of technological innovation: on the one hand, the industry-university-research collaboration platform for smart city construction has accelerated the integrated innovation of cutting-edge technologies such as artificial intelligence and blockchain; On the other hand, the environmental intelligent monitoring system compels enterprises to carry out green process innovation and promotes the evolution of technological innovation towards low-carbonization

3.Theoretical Analysis

(1) Direct impact

The core element of new quality productive forces is the organic unity of laborers, objects of labor and means of labor, and it has a strong driving force for development. First, the role of smart city construction in enhancing the quality of workers. The development of smart city construction has raised society's demands for digital skills talents and professionals in related industries, promoting the training and development of education and skills. Workers can learn the modular course system through the cloud architecture platform [22] to achieve personalized ability expansion. This lifelong learning mechanism has enhanced the digital application capabilities of workers and promoted the transformation of their skill systems towards a composite ability structure that meets the demands of the intelligent era [23]. When workers are seeking positions, this enhances the value they can exert and makes them more worthy of being hired. Second, the role of smart city construction in the intelligent upgrading of labor resources. The Internet of Things (iot) technology enables industrial equipment to have environmental perception and autonomous decision-making capabilities, and realizes digital collaboration throughout the entire production process through M2M communication [24]. This intelligent transformation not only enhances the operational efficiency of equipment but also reduces downtime losses through predictive maintenance. The intelligent dispatching system in the logistics field optimizes the transportation network based on real-time traffic data and combines blockchain technology to achieve full traceability of the supply chain [25], thus building an efficient circulation system for production factors. The application of intelligent warehouse robots and automated sorting systems has increased the labor efficiency in the logistics process by more than 30% [26], providing material guarantees for the development of new quality productivity. Third, the multi-dimensional improvement effect of smart city construction on the labor force. The big data generated by urban operation is transformed into decision support for urban governance and element resources for industrial innovation through cleaning, modeling and visualization processing. The development and utilization of this new type of labor object have given rise to emerging business forms such as smart transportation and precision medicine. Meanwhile, the engineering application of new materials such as nanomaterials and smart composite materials has broken through the single functional limitations of traditional materials. For instance, self-healing concrete extends the service life of infrastructure [27], and photovoltaic glass enables buildings to achieve self-sufficiency in energy. The application of these innovative materials has expanded the physical properties of the objects of labor and provided a material basis for the development of new quality productive forces.

Based on the above theoretical analysis, Hypothesis H1 is proposed: The construction of smart cities promotes the development of new quality productive forces.

(2) Indirect impact

The construction of smart cities promotes the improvement of human capital: The construction of smart cities reconfigures the model of human capital accumulation through the embedding of technology, indirectly empowering the development of new quality productive forces. Firstly, immersive education platforms based on digital twin technology (such as urban traffic simulation systems) transform abstract knowledge into visual scenarios, significantly enhancing the efficiency of skill acquisition [23]. Secondly, the urban data middle platform promotes cross-domain knowledge sharing. For instance, medical image data is desensitized and used for training AI-assisted diagnostic algorithms, accelerating the transformation of tacit experience into explicit technology [23]. Finally, the emerging occupations brought about by smart cities (such as digital twin engineers) force workers to transform from single skills to compound capabilities of "data thinking + scene application", forming a positive cycle where human capital and technological innovation coexist [28]. As a result, smart cities drive human capital to become the core lever of new quality productivity through three mechanisms: innovation in educational scenarios, upgrading of knowledge sharing, and reconstruction of the professional ecosystem.

The improvement of human capital level can effectively activate the endogenous driving force of new quality productivity. Under the framework of smart city development, by building a digital technology-oriented education and training system and focusing on cultivating compound talents with digital literacy and innovation capabilities, the connection efficiency between technological research and development and industrial application can be significantly enhanced. Such talents not only master cutting-edge technologies like artificial intelligence and big data analysis, but also possess practical capabilities for the digital transformation of industries. They can effectively promote the optimal allocation of data elements and the industrial transformation of technological achievements. When high-quality human capital is deeply integrated with the information infrastructure and innovation ecosystem of smart cities, it will accelerate the spillover effect of knowledge and the speed of technology diffusion, promoting a leap in total factor productivity.

Based on the above theoretical analysis, Hypothesis H2 is proposed: The construction of smart cities can enhance the level of human capital and thereby drive the improvement of qualitative productivity.

The construction of smart cities has a significant promoting effect on the development of science and technology. On the one hand, it provides rich application scenarios for technological innovation. For instance, to achieve intelligent functions such as automatic adjustment of street lamps and monitoring of garbage overflow, it is necessary to break through technical challenges such as precise sensor identification, low-energy consumption operation of equipment, and stable networking of large-scale equipment. These practical demands have directly driven the upgrading of Internet of Things (iot) technology. For instance, in urban traffic management systems [29], to conduct real-time analysis of traffic flow data and optimize the timing of traffic lights, artificial intelligence algorithms are constantly improving in complex data processing. Eventually, these technological breakthroughs can also be applied to other fields such as logistics scheduling and disaster early warning. On the other hand, this construction process builds an innovative network of multi-party collaboration. The pilot platform for smart communities built by the government has provided an opportunity for on-site testing of environmental monitoring technologies developed by universities. To address the issue of automatic parking space recognition, enterprises have collaborated with research institutions to develop more efficient image recognition models. These collaborations not only solve practical problems but also give rise to new patented technologies.

The level of science and technology has a significant promoting effect on new quality productivity. First of all, breakthroughs in cutting-edge technologies directly drive the leap in the form of productive forces. The new generation of disruptive technologies represented by artificial intelligence, quantum information and biotechnology have restructured the traditional way of allocating production factors. For instance, deep learning technology has significantly enhanced the accuracy of fault prediction and the efficiency of resource scheduling in industrial production by optimizing algorithm models. Further research on new energy and new materials has promoted the application and development of renewable energy, as well as the application of new materials such as lightweight and high-strength in aerospace, automotive manufacturing and other fields [30]. Finally, the coordinated evolution of data and computing power has strengthened the underlying support for the development of productivity. As a new type of production factor, the value release of data is highly dependent on the iterative upgrade of computing power infrastructure. Large language models represented by DeepSeek and ChatGPT rely on a powerful computing power foundation to collect vast amounts of data from the Internet, and through analysis, processing, and integration, output new knowledge achievements. It has revolutionized human society's perception of data and computing power as production factors.

Based on the above theoretical analysis, Hypothesis H3 is proposed: The construction of smart cities can enhance the level of science and technology and thereby drive the improvement of new quality productivity.

(3) Threshold effect

The promoting effect of smart city construction on new quality productive forces is restricted by the level of regional industrial structure upgrading, presenting a non-linear threshold feature. The essence of new quality productivity lies in the reconstruction of the traditional logic of factor allocation by data and intelligent technologies [31], and the upgrading of industrial structure determines the depth and breadth of technological integration. When regional industries are dominated by labor-intensive or resource-dependent ones, the rigid allocation of production factors and low technological adaptability will inhibit the technological penetration effect of smart cities, and its role is mostly limited to local efficiency improvement. With the transformation of the industrial structure towards knowledge-intensive fields, the accumulation of high-skilled human capital and the increase in the complexity of the innovation network [32] have created conditions for the systematic application of intelligent technologies. At this point, smart cities break down the barriers to factor flow through real-time data streams, driving production factors to aggregate in high-value-added fields. At the same time, they accelerate technology diffusion by relying on the innovative ecosystem of all-domain interconnection, achieving increasing returns to scale from technological dividends [33]. This dynamic adaptation mechanism of "technology - industry" indicates that the upgrading of industrial structure, by expanding the capacity for technology absorption, enhancing the flexibility of factor allocation and optimizing the efficiency of collaboration, promotes the enabling effect of smart cities on new quality productive forces to show a marginal increasing law.

Based on the above theoretical analysis, Hypothesis H4 is proposed: The promoting effect of smart city construction on new quality productivity increases with the improvement of the level of industrial structure upgrading, and there is a significant threshold effect.

4.Model Setting and Variable Selection

(1) Model Setting

Firstly, the article takes the smart city policies announced by the Ministry of Housing and Urban-Rural Development in 2012, 2013 and 2014 as natural quasi-experiments to analyze the impact of smart city construction on new quality productivity. The specific model is as follows:

$\mathrm{Nqpf}_{\mathrm{it}} = \alpha_1 + \alpha_2 \mathrm{did}_{\mathrm{it}} + \alpha_3 \mathrm{X}_{\mathrm{it}} + \gamma_{\mathrm{i}} + \mu_{\mathrm{t}} + \epsilon_{\mathrm{it}}$ Formula (1)

In Model (1), $\mathrm{Nqpf}_{\mathrm{it}}$ The table represents the explained variable, $\mathrm{did}_{\mathrm{it}}$ indicating the new quality productivity development level of city i in year t. As the explanatory variable, $\mathrm{did}_{\mathrm{it}}=\mathrm{Treat}_{\mathrm{i}} \times \mathrm{Time}_{\mathrm{t}}$. First, set the dummy variable Treat for the experimental group and the control group. If it is a pilot city for smart city policies, it is 1; if it is not a pilot city for smart city policies, it is 0. Secondly, set the Time dummy variable time. The year before becoming a smart city pilot city should be 0, and the year of becoming a pilot city and subsequent years should also be 0. X_{it},The representative control variables are respectively population density, economic development level, urbanization level, degree of government intervention and industrialization level. And respectively represent fixed time and fixed city, ϵ_{it} are random error terms.

Finally, to examine the mediating effect of mediating variables between smart city construction and new quality productivity, this article draws on Wen Zhonglin [34] (2004) and establishes a mediating effect model based on (1). The mediating effect regression model is set as follows:

$$\mathrm{M}_{\mathrm{it}} = \alpha_1 + \alpha_2 \mathrm{did}_{\mathrm{it}} + \alpha_3 \mathrm{X}_{\mathrm{it}} + \gamma_i + \mu_t + \epsilon_{it} \qquad \text{Formula (2)}$$

$$\mathrm{Nqpf}_{\mathrm{it}} = \alpha_1 + \alpha_2 \mathrm{did}_{it} + \alpha_3 M_{it} + \alpha_4 X_{it} + \gamma_i + \mu_t + \epsilon_{it} \qquad \text{Formula (3)}$$

(2) Variable Selection

Core explanatory variable

Smart City Construction (did) : According to the three batches of smart city construction pilot list released by the Ministry of Housing and Urban-Rural Development, if a city is a smart city pilot city, the value assigned to the year of pilot implementation and subsequent years is 1, and to the rest is 0. If a city is on the list of smart city pilot projects, all values will be 0 during the study period.

(3) The explained variable

New quality productivity (Nqpf), Marx believed, productivity is the ability of people to transform nature to meet demands, mainly composed of three elements: laborers, means of labor and objects of labor, with laborers being the key (Hu Ying) [35]. Therefore, referring to the research of Han Wenlong (2024) [36] and Ma Dan (2025) [37], this article constructs a new quality productivity index system from three major aspects: labor force, labor materials, and labor objects, with 15 indicators (Table 1), and adopts the entropy method to calculate the development index of new quality productivity.

Table 1 New Quality Productivity Index System

First-levelIn dicator	Second-level Indicator	Indicator Explanation	Direction	Weight
Laborers	Number of Employees in Emerging	Total number of employees in listed companies of	+	0.184

	Industries	strategic emerging industries and future industries, aggregated to prefecture-level cities by place of registration		
	Individual Ability of Employees	Average salary of on-the-job employees	+	0.018
	Educational Structure of Human Resources	Number of college and university students (undergraduate and junior college) in school	+	0.101
Means of Labor	Infrastructure	Number of mobile phone users	+	0.047
		Internet usage per 100 people	+	0.079
	Future Development	Robot installation density	+	0.046
	Scientific and Technological Innovation	Number of patent applications	+	0.048
		Ratio of R&D expenditure to local fiscal expenditure	+	0.025
Objects of Labor	Green Environmental Protection	Harmless treatment rate of domestic waste	+	0.024
		Centralized treatment rate of sewage treatment plants	+	0.182
		Comprehensive utilization rate of general industrial solid waste	+	0.002
	Industrial Development	Total volume of telecommunications business	+	0.002
		Ratio of industrial added value to gross regional product (GRP)	+	0.006
		Number of artificial intelligence (AI) enterprises	+	0.222
	Data Elements	Utilization level of data elements	+	0.006

(4)

Control variables

To eliminate the influence of other factors on the improvement of new quality productivity in smart city construction, the following control variables are added in the article: ① Economic development level () : The per capita gross domestic product is selected for representation. ② Population density (Pd) : It is represented by the ratio of population to urban area. ③ Urbanization level: It is expressed as the proportion of the urban population to the total population in a region. ④ Degree of Government intervention (Gov) : It is expressed as the ratio of general government fiscal expenditure to GDP. ⑤ Industrialization Level (Loi) : It is expressed as industrial added value

/GDP.

(5) Mediating variables

Human capital level: Select the number of regular undergraduate and junior college students currently enrolled/the total population at the end of the year.

Scientific and technological level: Select scientific and technological expenditure.

(6) Threshold variables

The upgrading of industrial structure: The added value of the tertiary industry in ten thousand yuan/the added value of the secondary industry in ten thousand yuan is selected for measurement.

(7) Data Sources

The article adopts 287 prefecture-level cities across the country from 2011 to 2022 as panel data. The data mainly come from the statistical yearbooks of prefecture-level cities, provincial statistical yearbooks, "China Rural Statistical Yearbook" and "China Social Statistical Yearbook". A few missing values are supplemented by interpolation method.

5.Empirical Analysis

(1) Benchmark regression

To study the impact of smart city policies on new quality productivity, this article adopted a differentially in-differences model for benchmark regression. The results are shown in Table 2. Columns (1) and (2) are the regression results without control variables and with control variables, respectively. Columns (3) and (4) indicate that no control variables have been added, but control is applied to time and individuals respectively. Column (5) represents the regression results that not only incorporate control variables but also control over time and individuals. The results indicate that. Whether time and individuals are controlled or not, and whether control variables are added or not, the impact coefficient of smart village construction on new quality productivity is significantly positive and passes the 1% significance test, indicating that smart city construction has a significant promoting effect on new quality productivity, and hypothesis H1 is thus established.

Table 2 Benchmark Regression Analysis

Variable	(1)	(2)	(3)	(4)	(5)
	Nqpf	Nqpf	Nqpf	Nqpf	Nqpf
did	0.758***	0.675***	1.345***	0.187***	0.184***
	(10.365)	(9.165)	(23.088)	(2.968)	(2.911)
Pd		0.090**			0.031
		(2.463)			(0.397)
Pergdp		0.429***			0.096
		(5.230)			(1.180)
Urb		0.119			0.305
		(0.384)			(0.755)
Gov		1.757***			0.472***
		(5.870)			(2.944)
Loi		-0.000			0.000***
		(-1.448)			(7.272)
Times	NO	NO	YES	NO	YES
Individual	NO	NO	NO	YES	YES
_cons	1.956***	-3.542***	1.801***	2.106***	0.637
	(52.163)	(-4.319)	(83.204)	(99.506)	(0.648)
N	3990	3990	3990	3990	3990

R2	0.026	0.045	0.745	0.842	0.842
F	107.440	31.440	533.038	8.807	10.523

(Note: ***, **, * respectively indicate significance at the 1%, 5%, and 10% levels. The values in parentheses are t values, "the same below")

(2) Placebo test

In this paper, among the 276 sample cities, a few cities were randomly selected as the treatment group, and the cities not selected were used as the control group. This process was repeated 500 times. As a result, we obtained 500 false estimation coefficients of "Broadband China" for the integrated development of urban and rural areas, as shown in Figure 1. The density distribution of the P-value points that constitute these policies shows that Most of these estimated coefficients are clustered around the 0 value, and their p-values are mostly above 0.1. The estimated coefficient of the actual policy dummy variable Band in this paper (0.213, as shown by the dotted line in the figure) is significantly different from the result of the placebo test, presenting as an outlier. This result indicates that the benchmark regression results exclude the possibility of being influenced by uncontrollable factors.

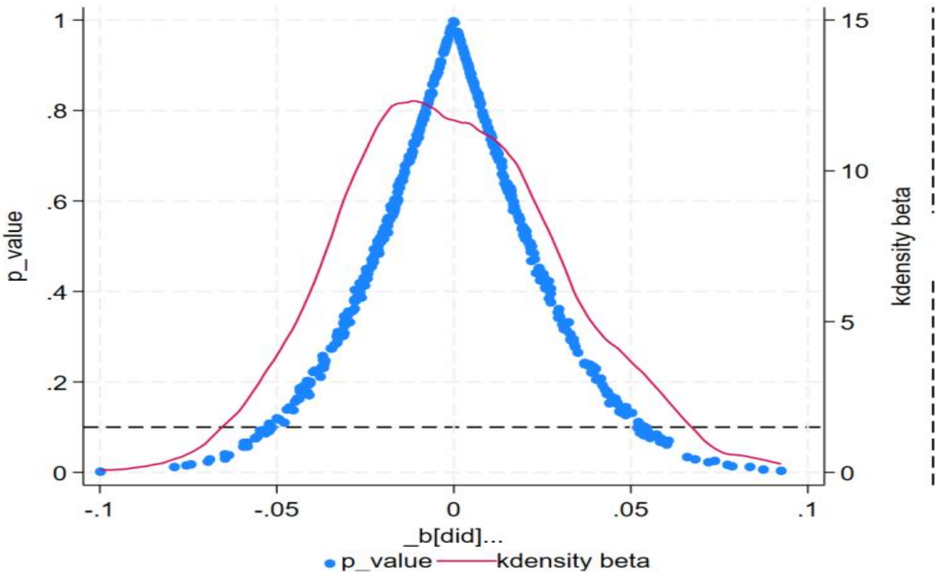

Figure 1 Placebo test

(3) Robustness test

Exclude municipalities directly under the Central Government

The drawback of PSM is that it cannot control the possible impact of unobservable variables on the regression results. As an infrastructure policy for specific regions, the "Smart City construction" policy may vary among municipalities directly under the Central Government due to the influence of their city size and economic development level. Therefore, the article adopts the approach of proposing municipalities directly under the Central Government (Beijing, Shanghai, Tianjin and Chongqing) for robustness tests. The specific results are shown in column (1) of Table 3. We find that after excluding the municipalities directly under the Central Government, the construction of smart cities still has a significant promoting effect on new quality productivity, and the conclusion is robust.

Eliminate the interference of other policies

Considering that the implementation of the "Smart City Construction" policy may confuse other policies of the same period, in order to ensure the validity of the experimental conclusion, this article sorts out other policies within the sample period and finds that the "Broadband China" policy announced the pilot cities of "Broadband China" three times from 2014 to 2016. Therefore, the article incorporates the dummy variable of the "Broadband China" policy into the model to eliminate its interference with the model results. The specific results are shown in column (2) of Table 3. We find that after substituting the "Broadband China" policy into the model, the construction of smart cities still has a significant positive impact on new quality productivity, and the conclusion remains robust.

PSM-DID

Given that propensity score matching combined with difference-in-differences models can effectively alleviate the "selection bias" problem in pilot policies, this paper adopts this model to further verify the robustness of the aforementioned estimation results. The article first adopts the one-to-one nearest neighbor matching method for matching and selects control variables (economic development level, population density, urbanization level, degree of government intervention and industrialization level) as covariates to screen samples. Secondly, through the balance test in Figure 2, it can be seen that the deviation of control variables in the experimental group and the control group is significantly reduced and remains within 5%. After passing the balance test, the model was finally estimated. The regression results are shown in column (3) of Table 3. We can see that the construction of smart cities has a significantly positive impact on new quality productivity, indicating that the estimation results mentioned above are robust.

Table 3 Robustness Test

Variables	(1) Excluding municipalities directly under the Central Government	(2) Broadband China	(3) PSM-DID	
	Nqpf	Nqpf	Nqpf	Nqpf
did	0.185***	0.179***	0.192***	0.160*
	(2.897)	(2.852)	(3.176)	(1.738)
Broadband China		-0.111**		
		(-2.113)		
Pd	0.121	0.113	0.115	0.234*
	(1.421)	(1.334)	(1.534)	(1.796)
Pergdp	0.140	0.136	0.156*	0.146
	(1.581)	(1.558)	(1.808)	(1.040)
Urb	0.369	0.413	0.438	0.117
	(0.903)	(1.025)	(1.388)	(0.251)
Gov	0.807*	0.760*	0.859**	0.112
	(1.800)	(1.732)	(2.394)	(0.231)
Loi	0.000***	0.000***	0.000	-0.938***
	(7.330)	(7.191)	(1.398)	(-3.688)
Time	YES	YES	YES	YES
Individual	YES	YES	YES	YES
_cons	-0.430	-0.358	-1.446	-1.338
	(-0.400)	(-0.336)	(-1.481)	(-0.837)
N	3892	3962	3963	1986
R2	0.842	0.842	0.448	0.461
F	10.241	8.867	156.489	75.754

Mechanism Verification

To study the mediating role of smart city construction on new quality productivity, the article selects the level of human capital and the level of science and technology as mediating variables. The results of the mechanism test regression are shown in Table 4. Column (1) represents the research on the impact of smart city construction on new quality productivity, and it is concluded that smart city construction significantly promotes the development of new quality productivity at the 1% level. Column (2) indicates the impact of smart city construction on the level of human capital. It is concluded that smart city construction promotes the advanced development of industrial outcomes, which is significant at the 5% level. Column (4) represents the impact of smart city construction on the level of science and technology. We find that the impact coefficient of smart city construction on the level of science and technology has passed the significance test of 5%, and the coefficient is positive. Column (5) represents the research on the impact of scientific and technological levels on new quality productivity. We concluded that scientific and technological levels promote the improvement of new quality productivity and passed the 5% significance test. The level of science and technology and the level of human capital play a mediating role in the construction of smart cities and the new quality productive forces, which proves the validity of hypotheses H2 and H3.

Table 4 Mechanism Test Results

Variable	(1) Nqpf	(2) Level of human capital	(3) Nqpf	(4) The level of science and technology	(5) Nqpf
did	0.184***	0.001**	0.159**	0.001**	0.159**
	(2.911)	(2.504)	(2.545)	(2.504)	(2.545)
Pd	0.031	0.001	0.016	0.001	0.016
	(0.397)	(1.249)	(0.200)	(1.249)	(0.200)
Pergdp	0.096	0.001	0.082	0.001	0.082
	(1.180)	(0.994)	(0.992)	(0.994)	(0.992)
Urb	0.305	-0.003	0.383	-0.003	0.383
	(0.755)	(-1.252)	(0.940)	(-1.252)	(0.940)
Gov	0.472***	0.005***	0.351**	0.005***	0.351**
	(2.944)	(3.344)	(2.303)	(3.344)	(2.303)
Loi	0.000***	-0.000	0.000***	-0.000	0.000***
	(7.272)	(-0.500)	(7.199)	(-0.500)	(7.199)
Level of human capital			22.650***		
			(9.009)		
The level of science and technology					22.650***
					(9.009)
Time	YES	YES	YES	YES	YES
Individual	YES	YES	YES	YES	YES
_cons	0.637	0.006	0.493	0.006	0.493
	(0.648)	(0.885)	(0.492)	(0.885)	(0.492)
N	3990	3990	3990	3990	3990
R^2	0.842	0.823	0.847	0.823	0.847
F	10.523	3.902	20.093	3.902	20.093

6.Threshold Effect

Based on the existing theoretical framework, it can be known that the impact of industrial structure upgrading on the construction of smart cities at different levels on new quality productivity varies. To deeply study this nonlinear relationship, this study selects industrial structure upgrading as the threshold variable and conducts 300 repeated sampling tests using the Bootstrap method. By constructing a triple threshold regression model (see the data in Table 5 for details), it was found that only the double and single threshold indicators passed the significance verification ($P<0.05$), while none of the triple threshold tests were significant. This indicates that the threshold variable of industrial structure upgrading passed the single threshold test, and a double threshold model should be constructed.

Table 5 Threshold Feature Test

Threshold Variable	Number of Thresholds	F-Statistic	P-Value
	Single Threshold	55.87	0.0033^{***}
Smart City	Double Thresholds	36.30	0.0200^{**}
Construction	Triple Thresholds	18.08	0.6100

In Table 5, we can see that when industrial structure upgrading is taken as the threshold variable, the estimated dual thresholds of smart city construction on new quality productivity are 0.5337 and 1.3028. When the threshold variable of industrial structure upgrading is lower than the first threshold value, the influence coefficient of the level of smart city construction on new quality productivity is significantly -0.696. And it passed the 1% significance test, but the construction of smart cities hinders the development of new quality productivity. When the threshold variable is higher than the single threshold value but lower than the second threshold value, the influence coefficient of the level of smart city construction on new quality productivity is significantly positive (0.254), but it only passes the 10% significance test. When the threshold variable is higher than the second threshold value, the influence coefficient of the level of smart city construction on new quality productivity is significantly positive (0.78), and it has passed the 1% significance test. Therefore, we find that the degree of influence shows an increasing trend, from the initial obstructive effect to the final promoting effect, which can be seen that the promoting effect of smart city construction on new quality productivity It will be affected by the upgrading of the industrial structure. The stronger the level of industrial structure upgrading, the stronger the promoting effect of the two.

Table 6 Threshold Regression Results

Threshold Interval of Industrial Structure Upgrading	Impact Coefficient (on New-Quality Productive Forces)
$LQ \leq 0.5337$	-0.696^{***}(0.178961)
$0.5337< LQ <1.3028$	0.254^{*}(1.89)
$LQ >1.3028$	0.78^{***}(3.36)
Control variable	Yes
_cons	-11.2^{***} (-7.55)
N	3962

Heterogeneity Analysis

1. Urban location heterogeneity

The impact of smart city construction on new quality productivity varies with different geographical locations. Therefore, in order to study the heterogeneity of smart city construction on new quality productivity, this article divided 285 prefecture-level cities across the country into eastern, central and western regions for group regression. The results are shown in Table 7. The article finds that the construction of smart cities in both the eastern and western regions has a positive promoting effect on new quality productivity. The western region has achieved a significance level of 1%, while the eastern region has achieved a significant new level of 10%. In the central region, the construction of smart cities has a heterogeneous effect on new quality productivity, but it is not significant. The main reason is that The eastern region usually has a relatively developed economic foundation, which provides sufficient financial support and technical guarantee for the construction of smart cities. The various applications and innovations of smart cities can be rapidly applied and promoted in economic activities, thereby driving the improvement of new quality productivity. To promote coordinated regional development, the central government has given more policy preferences and support to the western regions. These policies will help the western regions achieve breakthroughs in the construction of smart cities, thereby promoting the improvement of new quality productivity. Compared with the eastern and western regions, the economic foundation of the central region is relatively weak, which restricts the research and application of smart city technologies. Meanwhile, the central region may encounter bottlenecks in terms of funds and technology in the construction of smart cities, resulting in an insufficiently significant improvement in new quality productivity.

2. Heterogeneity in urban scale

The differences in urban size imply that cities vary in economic development, technological innovation, and other aspects, leading to heterogeneity in the new quality productivity of smart city construction. According to the "Notice of The State Council on Adjusting the Standards for Urban Size Classification", this article classifies cities into large cities and medium and small-sized cities and conducts group regression. The results are shown in Table 7. The article finds that The construction of smart cities in medium and small-sized cities has a significant promoting effect on new quality productivity, and the impact coefficient has passed the significance test of 1%. However, in large cities, it is not significant and there is an obstructive effect. The reason is that compared with large cities, medium and small-sized cities tend to be more concentrated and efficient in resource allocation. The construction of smart cities can make full use of limited resources and improve the efficiency of urban management and services through information and intelligent means, thereby significantly promoting new quality productivity. The advantage of this concentrated utilization of resources is particularly evident in medium and small-sized cities, as their urban scale is relatively small and it is easier to achieve the optimal allocation of resources. Due to their large scale and large population, the complexity of urban management and services in large cities is much higher than that in medium and small-sized cities. The construction of smart cities needs to confront more challenges and problems, such as traffic congestion, environmental pollution, and uneven resource allocation. These complex issues may lead to a slower pace and less significant effect of smart city construction in large cities.

Table 7 Results of Heterogeneity Analysis

Variable	Eastern China	Western China	Central China	Large Cities	Small and Medium-sized Cities
	Nqpf	Nqpf	Nqpf	Nqpf	Nqpf
did	0.203*	0.534***	-0.129	-0.111	0.343***
	(1.950)	(4.000)	(-1.394)	(-1.216)	(4.178)
Pd	0.208	-0.065	0.459***	0.061	0.198**
	(0.421)	(-1.124)	(4.172)	(0.559)	(2.205)
Pergdp	0.810***	0.423***	-0.620***	0.471***	0.083
	(5.512)	(3.015)	(-3.243)	(3.652)	(0.611)
Urb	0.513	3.054***	-0.694	-0.827	1.303**
	(0.755)	(3.738)	(-1.132)	(-1.543)	(2.306)

Gov	0.293	1.220	0.439	0.020	1.490**
	(0.743)	(1.411)	(0.545)	(0.072)	(2.322)
Loi	0.000***	-0.927**	-0.507***	0.000***	-0.542***
	(6.503)	(-2.421)	(-2.813)	(6.901)	(-3.209)
Time	YES	YES	YES	YES	YES
Individual	YES	YES	YES	YES	YES
_cons	-8.306**	-3.657**	6.484***	-2.958*	-0.643
	(-2.301)	(-2.326)	(2.956)	(-1.854)	(-0.432)
N	1400	1162	1400	1428	2534
R^2	0.837	0.868	0.838	0.842	0.845
F	10.791	7.842	7.777	9.844	8.384

7.Research Conclusions and Countermeasures Suggestions

(1) Research Conclusion

Based on the panel data of 285 prefecture-level cities across the country from 2011 to 2022, this article conducts a quasi-natural experiment with the pilot policies of "Smart cities", constructs a differin-differences model, and studies the direct impact, indirect impact, heterogeneity and threshold effect of smart city construction on new quality productivity The model was subjected to the exclusion of municipalities directly under the Central Government, the elimination of interference from other policies, and the robustness test of PSM-DID. The main conclusions are as follows:

Benchmark regression indicates that the model has a significant positive impact on new quality productivity, whether with control variables added, without control variables added, or with random effects models.

Mechanism tests show that both the level of human capital and the level of science and technology play a mediating role in the impact of smart city construction on new quality productivity.

In the heterogeneity test, among the eastern and western regions of urban location heterogeneity, the construction of smart cities has a significant promoting effect on new quality productivity. The significance in the western region is greater than that in the eastern region, while the influence coefficient in the central region is negative and not significant. In the heterogeneity of urban scale, the influence coefficient of large cities is negative and not significant. In medium and small-sized cities, the construction of smart cities has a promoting effect on new quality productivity.

In the threshold effect, there is a threshold effect in the upgrading of industrial structure. The promoting effect of smart city construction on new quality productive forces will be influenced by the upgrading of industrial structure. The stronger the level of industrial structure upgrading, the stronger the promoting effect of both.

(2) Countermeasures and Suggestions

First, promote the construction of new infrastructure related to smart cities. First of all, first of all, strengthen top-level design, formulate special plans to clarify phased goals, select key cities to carry out pilot demonstrations, and explore replicable paths. Establish a diversified investment mechanism, guide through government special funds, attract social capital to participate in the construction of 5G base stations, Internet of Things perception networks, urban data hubs, etc., and promote the PPP model to reduce fiscal pressure. Secondly, improve the standard system, unify data interfaces, device protocols and security norms, and promote the interconnection and interoperability of systems across departments and fields. Deepen the application of scenarios, give priority to the layout of smart transportation, healthcare, education and other fields related to people's livelihood, and utilize AI algorithms to optimize the scheduling of public resources. Finally, we should build a solid security barrier, establish a data classification protection system, strengthen the protection of critical information infrastructure, and conduct regular security drills. Strengthen talent cultivation, support universities in setting up interdisciplinary subjects related to smart cities, and encourage the joint construction of training bases by the government and enterprises. Through policy coordination, technological integration and demand traction, an integrated development pattern of "construction, management and operation" is formed, enabling new infrastructure to truly empower the modernization of urban governance.

Second, take human capital and scientific and technological levels as important means to promote the improvement of new quality productivity. In terms of human capital level, first of all, establish an interdisciplinary training system in the field of smart cities. Add the "Smart City Technology and Management" major in higher education institutions, focusing on cultivating compound talents who are proficient in information technology and possess urban governance thinking. Secondly, establish a global talent database for smart cities, implement targeted recruitment for scarce positions such as artificial intelligence trainers and urban digital twin architects, and provide "talent green card" policies such as individual income tax incentives and children's education guarantees for top international talents. Finally, a city-level talent sharing platform should be established, and flexible introduction mechanisms such as "Weekend Engineers" and "Remote Collaboration Experts" should be promoted to achieve cross-domain flow of talent resources. Establish an intercommunication mechanism between skills certification and professional title evaluation, incorporate digital technology certification into the professional title evaluation system, and open up career promotion channels for technical talents. In terms of scientific and technological levels, first of all, efforts should be made to promote cooperation among universities, research institutions and enterprises, and establish a collaborative innovation mechanism among industry, academia and research. By jointly building laboratories, research and development centers and other means, accelerate the transformation and application of scientific and technological achievements, so that technological innovation in smart city construction can better serve the cultivation of new quality productive forces. For example, jointly carry out research and application of projects such as intelligent transportation systems and smart energy management. Finally, a smart city scientific and technological achievement trading platform should be established to provide services such as information release and transaction matching for both the supply and demand sides of technology, reduce transaction costs, accelerate the market application of scientific and technological achievements, and promote the formation of new quality productive forces. At the same time, we should strengthen the protection of intellectual property rights and encourage enterprises and scientific researchers to actively carry out technological innovation and the transformation of achievements.

Third, promote the coordinated regional construction of smart cities. For the western regions, the government should increase policy inclination and financial input for the construction of smart cities in these areas. Establish a special fund to support project construction in key areas such as intelligent transportation, smart energy, and smart governance in the western region. Innovation leadership in the eastern region: The eastern region has a relatively solid foundation and should be encouraged to conduct higher-level innovative explorations in the construction of smart cities. Support the construction of international science and technology innovation centers in eastern cities, such as Shenzhen and other places, for innovative applications in cutting-edge fields like artificial intelligence and big data. For the central region, it is necessary to strengthen the planning and guidance for the construction of smart cities in the central region, avoid blind following of trends, and combine local industrial characteristics. For instance, some major agricultural provinces can focus on developing smart agriculture, and resource-based cities can concentrate on areas such as smart energy management, precisely positioning the direction of smart city construction. For the scale of cities, it is encouraged that small and medium-sized cities develop characteristic smart city applications based on local conditions. For instance, some small and medium-sized cities rich in tourism resources can build smart tourism systems to enhance the quality of tourism services and the experience of tourists, and promote the upgrading of the tourism industry. In terms of funds, through policies such as fiscal subsidies and tax incentives, guide social capital to invest in smart city construction projects in small and medium-sized cities.

Large cities should focus on addressing the "big city diseases" in urban development, and utilize smart city technologies to optimize the management of urban traffic congestion and enhance the efficiency of public service resource allocation, etc. For instance, by leveraging big data analysis to optimize the planning of urban bus routes and enhance the operational efficiency of public transportation.

Fourth, regions and industries at different stages of industrial structure upgrading should be given differentiated policy support. For regions with a high level of industrial structure upgrading and strong innovation capabilities, priority support should be given to their research and development of cutting-edge technologies and the construction of industrial innovation platforms to promote the development of emerging industry clusters. For instance, national-level artificial intelligence innovation centers should be established in some technologically advanced cities, and preferential treatment in terms of funds and land should be provided. For regions with relatively lagging industrial structure upgrading, efforts should be made to increase support for the transformation and upgrading of traditional industries, provide policies such as technological transformation subsidies and tax incentives, and encourage enterprises to phase out backward production capacity and introduce advanced production equipment and technologies. For instance, for traditional manufacturing enterprises that update their equipment, equipment purchase subsidies will be provided at a certain proportion. V. Research Conclusions and Countermeasures Suggestions

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References

[1] GAO Fan. New Quality Productive Forces and the Realization Mechanism of High-Quality Agricultural Development in China [J]. Issues in Agricultural Economy, 2024, (04): 58-67.

[2] HONG Yinxing, REN Baoping. Research on the Mechanism of Economic Growth Kinetic Energy Transformation under the New Development Pattern [J]. Economic Research Journal, 2021, 56(5): 4-18.

[3] Sanya Tourism Development Commission. Big Data-Driven Smart Tourism Management Practices [J]. Tourism Tribune, 2016(4): 45-49.

[4] JIANG Xiaojuan, HUANG Yiping. Research on the Driving Mechanism of Smart Cities on Total Factor Productivity [J]. China Industrial Economics, 2022(6): 5-23.

[5] ZHANG Weidong, DING Hai, SHI Daqian. The Impact of Smart City Construction on Total Factor Productivity—Based on a Quasi-Natural Experiment [J]. Technology Economics, 2018, 37(3): 107-114.

[6] SHI Yitao, ZHANG Xibao. Does Smart City Construction Promote Financial Development? — A Quasi-Natural Experiment Study Based on Smart City Initiative [J]. Finance and Economy, 2019, (12): 82-88.

[7] LIU Chengkun, ZHANG Minghong. Can Cities Become "Green and Inclusive" through "Smartness"? — A Quasi-Natural Experiment Based on China's Smart City Pilots [J]. China Population, Resources and Environment, 2024, 34(1): 175-188.

[8] ZHAO Jianjun, JIA Xinjing. Can Smart City Construction Promote the Transformation and Upgrading of Urban Industrial Structure?—A Quasi-Natural Experiment Based on 285 Prefecture-Level Cities in China [J]. Industrial Economic Review, 2019, 10(5): 46-60.

[9] Federico Caprotti, Robert Cowley. Varieties of smart urbanism in the UK : Discursive logics, the state and local urban context[J].Transactions of the Institute of British Geographers,2019,44(3):587-601.

[10] Victoria Fernandez-Anez, José Miguel Fernández-Güell, Rudolf Giffinger. Smart City implementation and discourses: An integrated conceptual model. The case of Vienna[J].Cities,2018,78:4-16.

[11] GAO Fan. New Quality Productive Forces and the Realization Mechanism of High-Quality Agricultural Development in China [J]. Issues in Agricultural Economy, 2024, (04): 58-67.

[12] ZHOU Wen, XU Lingyun. On New Quality Productive Forces: Connotation, Characteristics and Key Focal Points [J]. Reform, 2023, (10): 1-13.

[13] LU Jiang, GUO Ziang, WANG Yuping. The Development Level, Regional Differences and Improvement Paths of New Quality Productive Forces [J]. Journal of Chongqing University (Social Science Edition), 2024, 30(3): 1-17.

[14] HAN Wenlong, ZHANG Ruisheng, ZHAO Feng. Measurement of New Quality Productive Forces Level and New Kinetic Energy of China's Economic Growth [J]. The Journal of Quantitative & Technical Economics, 2024, 41(6): 5-25.

[15] WANG Jue. New Quality Productive Forces: A Theoretical Framework and Indicator System [J]. Journal of Northwest University (Philosophy and Social Sciences Edition), 2024, 54(01): 35-44.

[16] SUN Liwei, GUO Junhua. Construction and Empirical Measurement of an Evaluation Indicator System for New Quality Productive Forces [J]. Statistics and Decision, 2024, 40(09): 5-11.

[17] WEI Lin, MA Mengru. Digital Economy Development and Enterprise Green Innovation — A Quasi-Natural Experiment Based on the "Smart City" Pilot Construction [J]. Modern Finance and Economics (Journal of Tianjin University of Finance and Economics), 2022, 42(8): 24-40.

[18] SONG Deyong, LI Chao, LI Xiangyou. Does New Infrastructure Construction Promote the "Simultaneous Improvement in Quantity and Quality" of Green Technology Innovation?—Evidence from the National Smart City Pilot Program [J]. China Population, Resources and Environment, 2021, 31(11): 155-164.

[19] XIE Xiaoqin, REN Shihui. Agile Governance-Driven Megacity Governance in the Digital Economy Era—Empirical Evidence from Chengdu's Smart City Construction [J]. Urban Problems, 2022, (2): 86-95.

[20] HUI Xianbo. Digital Economy, Entrepreneurial Activity and Common Prosperity—Evidence from Smart City Construction [J]. Contemporary Economy and Management, 2023, 45(5): 18-24.
[21] WANG Jie, ZHANG Jinying, LIU Gang. Smart City Construction and New Quality Productive Forces—Reflections Based on Nordhaus's Question [J]. Journal of Yunnan University of Finance and Economics, 2024, 40(9): 47-64.
[22] CHEN Xiaohong, REN Xiaosong, WANG Yangjie. Research on Vocational Education Model Innovation in the Digital Economy Era [J]. Management World, 2021, 37(8): 88-102.
[23] CAI Fang. Human Capital Iteration and High-Quality Development: The Chinese Experience [J]. Economic Research Journal, 2020, 55(3): 4-20.
[24] LI Deyi, LIU Wei, WANG Feiyue. Industrial Internet of Things Technology System and Development Path [J]. Acta Automatica Sinica, 2020, 46(5): 831-845.
[25] WU Jiannan, ZHANG Pan. Research on the Mechanism of Blockchain-Driven Supply Chain Transparency Improvement [J]. Journal of Management Sciences in China, 2019, 22(4): 45-60.
[26] ZHANG Tao, LIU Qiang. Empirical Analysis of Efficiency Optimization for Intelligent Warehouse Robot Systems [J]. Industrial Engineering and Management, 2021, 26(2): 112-120.
[27] ZHANG Xiong, LI Ming. Research Progress on Properties and Applications of Self-Healing Concrete Materials [J]. Journal of Building Materials, 2018, 21(6): 899-907.
[28] WU Xiaobo, LEI Linan. Technology-Skill Matching and Industrial Upgrading Path under the Background of Digital Transformation [J]. Studies in Science of Science, 2019, 37(11): 1941-1952.
[29] LI Deren. Digital Twin City: A New Height of Smart City Construction [J]. China Survey and Design, 2020, (10): 13-14.
[30] SHI Jianxun, XU Ling. Research on the Significant Strategic Significance and Realization Path of Accelerating the Formation of New Quality Productive Forces [J]. Research on Financial and Economic Issues, 2024, (1): 3-1.
[31] NING Chaoshan. Digital Economy, Factor Allocation and High-Quality Development—An Empirical Study Based on Spatial Spillover Effects [J]. Management World, 2020, 36(12): 65-80.
[32] CAI Fang, WANG Meiyan. Industrial Structure Upgrading and Total Factor Productivity Growth—An Analysis Based on Chinese City Panel Data [J]. Economic Research Journal, 2020, 55(8): 45-60.
[33] LIU Wei, ZHANG Jianhua, LI Xuesong. The Nonlinear Relationship between Smart City Construction and Regional Innovation Efficiency—An Analysis Based on the Threshold Effect of Industrial Structure [J]. China Industrial Economics, 2021(5): 78-95.
[34] WEN Zhonglin, ZHANG Lei, HOU Jietai, LIU Hongyun. The Testing Procedure and Application of Mediating Effects [J]. Acta Psychologica Sinica, 2004, (05): 614-620.
[35] HU Ying, LIU Keng. Research on the Internal Mechanism of New Quality Productive Forces Promoting High-Quality Economic Development—Based on the Perspective of Marx's Productivity Theory [J]. Economist, 2024, (05): 5-14.
[36] HAN Wenlong, ZHANG Ruisheng, ZHAO Feng. Measurement of New Quality Productive Forces Level and New Kinetic Energy of China's Economic Growth [J]. The Journal of Quantitative & Technical Economics, 2024, 41(6): 5-25.
[37] MA Dan, CHEN Sinian, LEI Leyao, HE Zekai. Research on the Impact of New Quality Productive Forces on the Resilience of Urban Industrial Chains [J]. Statistics and Information Forum, 2025, 40(02): 19-35.