

Research on the Impact of Smart City Construction on High-quality Economic Development

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ABSTRACT

The construction of smart cities has been positioned by many local governments as an engine to complete industrial structure upgrading and lead high-quality regional economic development. This article selects data samples from 261 prefecture-level cities in China from 2004 to 2021 and uses a quasi-natural experiment method to conduct an in-depth study on the relationship between smart city construction and high-quality urban economic development. The results show that the construction of smart cities mainly realizes the spillover effect of high-quality urban economic development by enhancing the resilience level of cities. This spillover effect is relatively significant in China's eastern and central regions and is more pronounced in cities with larger population scales. Therefore, it is of great significance to reasonably expand the pilot scope of smart cities and formulate appropriate urban smart network system plans according to the characteristics of different regions to enhance urban resilience, prevent systemic risks, and thus promote high-quality urban economic development.

KEYWORDS

Smart City; High-quality Development; Urban Resilience.

1. INTRODUCTION

Self-reliance and self-improvement in science and technology are important strategic supports for national development. The construction of smart cities is currently the main choice for urban top-level design and transformation and upgrading, and is also one of the important carriers for the development of the digital economy. The construction of smart cities has shown important influence in promoting technological innovation, adjusting resource distribution, leading industrial upgrading, and improving economic benefits [1]. The construction of smart cities has become an important strategy for China to promote local economic quality development and is also one of the key driving forces for promoting healthy regional economic development [2]. From the existing literature, scholars' research on the construction of smart cities mainly focuses on how the construction of smart cities affects urban technological innovation capabilities, innovation paths, industrial structure upgrading, and economic development methods [3-6]. Although the academic community has conducted in-depth research and discussion on the impact of smart city construction on high-quality economic development, there are few empirical studies on the spillover effects of smart city construction on high-quality economic development. In fact, the content areas involved in the construction of smart cities, as well as the factors that affect the level of smart city construction, are actually quite complex in practice. This can lead to different or even opposing conclusions when different scholars use different methods and data to study local issues in the construction of smart cities. Therefore, based on previous research, this paper will expand the sample size and increase the

time span in order to make the research conclusions more representative and to clarify whether the spillover effects of high-quality economic development from the construction of smart cities are significant, what the interaction mechanisms are, and whether there are regional differences in the impact on high-quality economic development.

The rapid urbanization process has led to the accumulation of urban development risks. Faced with various unknown and unpredictable risks, the "vulnerability" and "inability to cope" of cities have become increasingly evident, which has become a key issue hindering sustainable urban development and has attracted widespread attention from urban managers and scholars. To overcome this urban management challenge, the concept of resilient cities has emerged and gained widespread recognition from many scholars and urban managers. Its goal is to enable cities to proactively respond to and withstand risk impacts, thereby achieving stable urban development. As one of the important goals of urban development, the concept of resilient cities has been widely promoted in the field of urban governance and is considered the main direction for future urban development. However, since the concept of urban resilience has not been proposed for long, its connotation is still at a relatively macro level. In fact, factors such as urban technological innovation, innovation paths, industrial structure upgrading, and economic development methods are all related to the concept of urban resilience to varying degrees. In practice, although the construction of smart cities has achieved the dual goals of assisting urban management and sustainable urban development by integrating digital information technology, and has enabled urban management decision-makers to formulate more economically effective resource allocation solutions and make faster resource allocation responses in the process of public resource allocation, it remains to be further studied whether the construction of smart cities can definitely create a more resilient urban operation system. Therefore, the research on the relationship between the construction of smart cities and the resilient urban operation system will be a topic of great academic value.

At present, research on the construction of smart cities and high-quality urban economic development in China mainly focuses on two dimensions: First, starting from the relevant policies of smart city construction, it explores the means and implementation paths of smart city construction and its impact on high-quality urban economic development; Second, empirical analysis methods are used to verify the spillover effects of smart city construction on high-quality economic development. For example, existing research results have examined whether smart city construction has a spillover effect on high-quality economic development from aspects such as technological innovation, industrial structure upgrading, and energy conservation and emission reduction. Among them, the most literature results examine the spillover effects of smart city construction on high-quality economic development from the aspect of technological innovation, which will not be repeated here; In terms of industrial structure upgrading, Chen Yunhao (2021) pointed out that the construction of smart cities can optimize the urban spatial structure and promote the development of emerging industries, so the contribution of smart city construction to industrial structure upgrading has formed a significant spillover effect on economic growth; In terms of energy conservation and emission reduction, the research by Jie Xiaoyan and Huang Yazhuo (2022) shows that smart city construction can reduce urban environmental pollution through innovative technological means and measures to improve urban energy efficiency, so the contribution of smart city construction to urban environmental protection has also formed a relatively significant spillover effect on economic growth. Overall, existing literature mostly discusses the spillover effects of smart city construction on high-quality economic development from a single aspect of urban resilience characteristics. However, the existing research results do not show a clear mechanism of action between smart city construction and urban resilience, either in concept or in their interrelationship. Therefore, how the spillover effects of high-quality economic development from smart city construction are related to urban resilience is a theoretical issue worthy of research.

2. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

Currently, the construction of smart cities has attracted a great deal of academic attention. Moreover, since its spillover effects on high-quality economic development are closely related to the improvement of social welfare levels, the relevant policy practices of smart city construction involve many dimensions that affect the improvement of social welfare levels. This is also the main reason why current social science literature generally does not study smart city construction separately from economic development or the improvement of social welfare levels. The concept of smart cities has evolved from macro to micro and from abstract to concrete. The current widely accepted definition is that a smart city is a combination of technology and urban development and is an organic system composed of three driving elements: community, technology, and policy. The construction of smart cities promotes continuous urban innovation and development through the mechanism of information infrastructure and digital empowerment. At the same time, the construction of smart cities also continuously promotes industrial upgrading through industry innovation, technological development, and consumption effects, achieving higher-quality urban development. The concept of high-quality economic development is even richer. Scholars have defined it from different dimensions, making it difficult to form a unified expression for the time being. However, their views have similarities. To sum up, the relatively accepted expression is: based on the current cutting-edge level of technology, the coordinated and stable state of economic development in innovation, green, openness, and sharing, which pays more attention to sustainability and the interactive feelings of economic participants, rather than the speed of economic growth. In summary, the connotations of "smart cities" and "high-quality economic development" have a high degree of consistency in their logical core to a certain extent, such as in technological innovation, ecology, and sustainable construction.

According to the core logic of smart city construction, it has the ability to gather and utilize innovative resources, which is the basic force to promote technological progress and promote organizational transformation. Urban construction relies on the continuous transformation or renewal of traditional organizations in the city, endowing the city's economy with stronger adaptability and creativity, thereby continuously promoting high-quality urban economic development. First, in the production field of urban economy, the construction of smart cities can not only enhance the effectiveness of urban management practices through the use of new-generation information technology but also provide a better business environment for enterprise development and provide intelligent support for enterprises to rely on technological means for structural upgrading, ultimately promoting the steady improvement of urban productivity levels and promoting other technological innovations and extensions in the city to a higher level. Second, in the consumption aspect of urban economy, with the continuous popularization of mobile Internet and other information technologies, the construction of smart cities can better integrate product innovation, user experience innovation, and consumption payment innovation generated by enterprises through new information technologies into the smart city management network, greatly reducing residents' consumption transaction costs and improving enterprise sales efficiency. The greatest benefit of the integration of smart city construction and enterprise technological progress is that it can continuously upgrade the market demand for emerging products, promote the continuous optimization of consumption structure and supporting services, and thus achieve the goal of upgrading urban consumption structure. Third, in terms of urban operation efficiency, smart city construction can rely on scientific management and intelligent application system upgrades to continuously improve the functions of urban operation units, enhance their ability to respond to various urban operation problems and response speed, thereby improving government control capabilities and urban operation efficiency. On this basis, smart city construction can guide and integrate high-quality factor resources and rely on new-generation information technology to promote innovative urban economic development and make urban economic operations more efficient and flexible. At the same time, smart city construction can also optimize urban services, improve urban living standards, help cities cope with complex and changing economic and social environments, and ultimately achieve the goal of improving the overall level of social welfare. The

contributions of smart city construction in the above three aspects constitute the key path for its formation of spillover effects on high-quality economic development in the urban operation process.

Undoubtedly, the core of technological innovation consists of technology research and development, product upgrades, market changes, innovative resource allocation, and industry changes. Technological innovation provides an important driving force for high-quality urban economic growth, making the driving mode of urban economic growth more focused on innovation-driven. The key to smart city construction is to improve the level of "comprehensive intelligence and sharing" and to comprehensively coordinate the needs of urban construction and social people's livelihood in economic, cultural, ecological, and institutional fields, thereby achieving the goal of improving the level of social welfare. Based on the inseparable relationship between smart city construction and high-quality urban economic development, starting from the implementation of China's smart city pilot policy, this paper puts forward Hypothesis 1.

H1: Smart city construction can significantly promote high-quality urban economic development.

3. RESEARCH DESIGN

This paper uses data from 237 prefecture-level cities in China from 2004 to 2021 as the research sample. Based on the three batches of smart city pilot lists published by the Ministry of Housing and Urban-Rural Development and the Ministry of Science and Technology, and according to the announcements by the Ministry of Housing and Urban-Rural Development in 2012, 2013, and 2015, the cities are valued, with smart city construction presented in the form of a dummy variable. At the same time, the construction of smart city pilots is regarded as a policy intervention tool, and the interaction term of the city dummy variable and the time dummy variable, divided according to the policy, is used as the main explanatory variable to assess the policy effect of smart city construction in improving high-quality urban economic development.

Although the current indicator system for measuring high-quality economic development is already very rich, each indicator has representative characteristics. However, a consistent and authoritative evaluation indicator system has not yet been formed in China. Due to the different selection of indicators and methods of weight setting, the evaluation system for high-quality economic development generally has a large degree of subjectivity, and there are significant differences in the measurement results. In terms of using a single indicator to measure the quality of economic growth, total factor productivity (TFP) is a widely accepted method. This method can not only be quantitatively measured but also can well reflect the quality of economic growth. Zheng Yuxin (2007) [7] believes that increasing the contribution rate of total factor productivity growth to economic quality should be an important goal of economic development, as technological progress is an important reason for driving total factor productivity growth. If the economic operation is contrary to this goal, it can be determined that the quality of economic growth is not high. With the increasing impact of resource and environmental constraints on economic growth, scholars have begun to use the green total factor productivity, which takes into account undesirable outputs, to evaluate the quality of economic growth. At present, green total factor productivity has become one of the important indicators for measuring high-quality economic development. In the research by Bian Yuanchao et al. (2019) [8] using green total factor productivity to assess high-quality economic development, compared with the stochastic frontier parameter method, the non-parametric data envelopment analysis (DEA) method does not require too many subjective assumptions, is suitable for production functions with multiple inputs and outputs, and is not affected by the dimension of indicators. Liu Yong et al. (2010) [9] used six evaluation models (undesirable output as input method, reciprocal transformation method, hyperbolic method, transformation vector method, directional distance function method, SBM model method) to evaluate environmental efficiency, and compared the advantages and disadvantages of various methods in dealing with undesirable outputs, and finally concluded that the SBM model is the most effective measurement method among them. Based on the

comprehensive absorption of the methods and ideas of the above scholars, this paper mainly refers to the research method of Gong Yuanyuan and Zhou Junjie (2021) [10], and uses the Super-SBM model, which takes into account undesirable outputs, to assess the level of high-quality economic development in terms of indicator selection and method. The data used in this paper come from the "China City Statistical Yearbook," "China Statistical Yearbook," Wind Information Database, and statistical yearbooks of various provinces.

In terms of urban resilience evaluation, this paper refers to the interpretation of urban resilience by Zhao Ruidong et al. (2020) [11]. Currently, the academic community has not yet reached a consensus on the assessment of urban resilience levels. Using a single indicator to measure the level of urban resilience may have significant dimensional defects, leading to one-sided conclusions and policy recommendations. In contrast, a multi-indicator system can not only avoid the one-sidedness of the assessment but also effectively address the inaccuracy in identification caused by econometric methods. Therefore, this paper draws on the indicator system constructed by Zhang Mingdou and Feng Xiaoqing (2018) [12]. The data are sourced from the "China City Statistical Yearbook," "China Statistical Yearbook," Wind Information Database, and statistical yearbooks of various provinces. Finally, this paper constructs an urban resilience index using the principal component analysis method, which serves as an indicator to measure the level of urban resilience.

This paper employs a quasi-natural experiment approach, using the smart city pilot policy as the intervention variable, to explore the impact of this policy on high-quality regional economic development. Additionally, based on the PSM-DID model, sample data at the prefecture-level city level for 237 cities were selected for analysis. In accordance with the basic requirements of the difference-in-differences (DID) model, this paper newly established two dummy variables: policy, which takes a value of 1 when the control group is a pilot city and 0 when it is a non-pilot city; and time, which takes a value of 0 before 2012 and 1 from 2012 onwards. To avoid sample selection bias and endogeneity issues, this paper, following the method of Shi Daqian et al. (2018) [13], excluded prefecture-level cities where pilot cities are located during the benchmark regression. The setting of the regression model and the empirical analysis are aimed at verifying H1.

4. RESULTS

This paper employs a fixed-effects model and uses clustered robust standard errors to conduct the benchmark regression. After adding control variables, the research results show that the impact of smart city construction on high-quality urban economic development is slightly reduced. This indicates that after controlling for other variables that may affect the outcome, the impact of smart city construction on high-quality urban economic development may be subject to interference or moderation from other factors, but it remains significant at the 1% statistical level. Columns (3) and (4) present the regression results using the panel fixed-effects model, where column (3) does not control for time-varying effects, and the impact of smart city construction on high-quality urban economic development is 0.032 and significant at the 1% statistical level; column (4) uses two-way fixed-effects regression, and the results do not show significant fluctuations. Therefore, the benchmark regression results indicate that smart city construction has a positive effect on promoting high-quality urban economic development, and H1 is verified.

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