The Impact of Digital Economy on New Urbanization in Shanxi Province

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Abstract: In recent years, the digital economy has increasingly become a significant driver of economic growth in China, with its tremendous potential affecting various aspects of the country's economic and social sectors. Shanxi Province is renowned for being a resource-based coal city in China and is currently in a critical period of developing new urbanization. Investigating whether the development of the digital economy in Shanxi Province positively influences new urbanization is of great importance for regional development. This study utilizes panel data from 11 prefecture-level cities in Shanxi Province from 2004 to 2017 and constructs a comprehensive indicator system for new urbanization, including economic urbanization, social urbanization, spatial urbanization, and population urbanization. The study calculates the comprehensive index of new urbanization in Shanxi Province and the level of the digital economy in Shanxi Province using the entropy weight method. Based on these indicators, a fixed-effects panel data regression model is established to quantitatively examine the impact of the digital economy's development level on the construction of new urbanization in Shanxi Province. The study reveals that (1) the regional development level of the digital economy in Shanxi Province has a significant positive promotion effect on new urbanization. (2) Regional government intervention in Shanxi Province plays a strong positive guiding role in the development of new urbanization. (3) The enhancement of the comprehensive economic strength of Shanxi Province significantly affects new urbanization construction, but the effect is not substantial.

Keywords: digital economy, new urbanization

1. Introduction

Urbanization is a natural historical process that accompanies the development of industrialization, characterized by the agglomeration of non-agricultural industries in urban areas and the concentration of rural populations in cities. It represents an objective trend in human social development and serves as a crucial indicator of a country's modernization. Since the initiation of economic reforms and opening up, China's economic strength has significantly increased in tandem with the accelerated process of industrialization. Consequently, China's urbanization has undergone a period of rapid development, marked by a low starting point and high speed. However, this rapid urbanization has also given rise to various complex challenges and issues, such as the integration difficulties faced by a large number of rural-to-urban migrant populations into urban society and the lagging progress in achieving citizenship status. Another issue is the faster pace of land urbanization compared to

population urbanization, leading to inefficient land use. The new urbanization is not only an essential milestone on the path to modernization but also a fundamental guarantee for China's long-term, sustainable economic and social development. As the emphasis on the quality of urbanization development has become a widely recognized priority, China has introduced a new urbanization development strategy that focuses on putting people first while balancing quality and scale.

In recent years, against the backdrop of slowing economic growth, demographic changes, and a sustained downturn in national economic development, the urgency of transitioning and developing the economy has become increasingly evident. Urbanization holds significant importance for economic and social development. The "National New Urbanization Plan" released in 2014 pointed out that domestic demand is the fundamental driver of China's economic development, and the greatest potential for expanding domestic demand lies in urbanization. Consequently, the country has placed increasing importance on the development of new urbanization. On March 5, 2019, Premier Li Keqiang, in the 2019 Government Work Report, stressed the need to promote regional coordination and enhance the quality of new urbanization. In May 2020, Premier Li Keqiang emphasized new urbanization twice in his government work report to the Thirteenth National People's Congress. The first instance highlighted the support for the development of "two new types of urbanization and one major urbanization," with one of the priorities being to "strengthen the development of new urbanization, leveraging the role of central cities and urban agglomerations to nurture industries and create employment opportunities." The second mention emphasized "advancing new urbanization in depth." In April 2021, the National Development and Reform Commission issued the "Key Tasks for New Urbanization and Urban-Rural Integration Development in 2021," which called for the promotion of new urbanization centered on county towns, fostering the coordinated development of large, medium, and small cities and towns, improving urban governance, and advancing urban-rural integration development. The frequency of policy directives underscores the importance and urgency of new urbanization construction.

China's digital economy has experienced rapid growth and has become a critical driver of the country's economic expansion. The "Fourteenth Five-Year Plan for National Economic and Social Development and the Long-Range Objectives Through the Year 2035" explicitly states the need to accelerate digital development and create new advantages in the digital economy. This involves using digitalization to drive transformative changes in production methods, lifestyles, and governance. This underscores the current role of the digital economy as a new engine and new impetus for China's economic transformation and the development of new urbanization.

The "China Digital Economy Development White Paper" released by the China Academy of Information and Communications Technology in April 2021 indicated that China's digital economy had grown from 9.49 trillion yuan in 2011 to 39.2 trillion yuan in 2020, and its share of GDP had increased from 20.3% to 38.6%. This accounts for more than a third of GDP, and the growth rate of the digital economy was more than 3.2 times that of nominal GDP during the same period. It is evident that the significant power of the digital economy has already influenced various aspects of China's economy and society. Against this backdrop, the rapid rise of new urbanization construction and the digital economy in China shares common ground. During the Thirteenth Five-Year Plan period, China made significant progress in the fields of digital economy and information-based urbanization. The digital economy witnessed remarkable development and achievements and began playing an increasingly significant role in global digital economic development. Furthermore, China's people-centered and quality-oriented approach to new urbanization construction has achieved notable results. Currently, there is a wealth of research on digital economy or new urbanization. However, there is a scarcity of studies that explore the integrated development of the digital economy and new urbanization. Hence, there is an urgent need for research that integrates these two dimensions.

Shanxi Province, known for its abundant coal resources, is at a critical juncture in the development of new urbanization. Reflecting on the history of urbanization in Shanxi Province, it is evident that the development model the province has adhered to over the years has inevitably led to numerous problems, resulting in irreparable losses for the economy and society. With the gradual popularization of new concepts, the traditional concept of urbanization can no longer adequately meet the current needs of social development. Therefore, urbanization construction should emphasize the coordination between urban and rural areas and the sustainability of development. It should prioritize economic, social, and ecological benefits, becoming the inevitable choice for Shanxi Province's future urbanization construction. The development of the digital economy can provide new growth points for various regions in Shanxi Province and better align with the laws governing modern industrial development.

Given these considerations, this study will explore the impact of Shanxi Province's digital economy development on the construction of new urbanization through literature review and empirical testing.

2. Literature Review

The new urbanization is characterized by comprehensive urban-rural planning, urban-rural integration, interactive industries, efficient use of resources, ecological livability, and harmonious development. It emphasizes the coordinated development of large, medium, and small cities, small towns, and new rural communities, mutually promoting each other's development. Vigorously advancing urbanization can drive local social progress and is an important means of improving people's quality of life. However, traditional urbanization has also brought about a range of issues, such as the emergence of a rural-urban dual structure, environmental pollution, and employment pressure.

Currently, there is a diverse body of literature on new urbanization, with many researchers offering their unique perspectives on the subject. The new urbanization represents a novel and distinctive development model. Lian Qingxin et al. (2013) contend that the new urbanization constitutes a multi-dimensional, all-encompassing system involving economic, social, environmental, and quality of life aspects. It does not solely revolve around the migration of the population from rural to urban areas but places greater emphasis on improving the quality of urbanization, focusing on the simultaneous development of social life, resources, the environment, and the economy (Zhang Zongyi et al., 2015). Wang Boyu et al. (2013) suggest that the main features of the current new urbanization construction include principles such as overall planning and coordination, the pursuit of a harmonious society, and comprehensive, coordinated, and sustainable development.

It is evident that the concept of new urbanization is more comprehensive, encompassing various aspects such as population, society, economy, environment, and space, not just limited to the movement of the population. New urbanization advocates for the synchronous development of industries with urbanization, focuses on improving the quality of people's lives, increases investment in and governance of environmental initiatives, and continually enhances public services. New urbanization represents the inevitable choice for future urban development and offers a more comprehensive and scientific reflection of a city's overall strength and living standards.

China's digital economy has been gaining prominence and plays a systematic and holistic role in shaping the development of urban industries. In the traditional industrial age, the gap between small and medium-sized towns and large cities gradually widened as industrialization advanced. However, the digital economy has provided a new path for the development of traditional urban industries. On one hand, the rise of the digital economy has given traditional urban industries the wings of digitization, networking, and intelligence, promoting the restructuring of the traditional industrial

chain organization from four dimensions: the supply chain, the enterprise chain, the spatial chain, and the value chain. This effectively boosts the strength of urban industrial chains (Chen Xiaodong & Yang Xiaoxia, 2021). On the other hand, under the impetus of digital technology, it continues to drive traditional industries toward internet-based, service-oriented development, effectively expanding the development space of urban industries. This leads to the creation of a platform-based service system centered around cities, rational industrial and service planning, and layout (Huang Tianlong & Luo Yongtai, 2015). Simultaneously, rural areas constitute an important component of new urbanization construction. The digital economy promotes significant changes in agricultural production methods, increasing agricultural productivity through innovation in information technology, expanding the production possibilities of rural industries through information network platforms, and optimizing the flow of production factors between urban and rural areas. This effectively promotes agricultural upgrading, rural development, and the development of rural populations (Wen Tao & Chen Yiming, 2020).

Research on the factors influencing the development of new urbanization mainly focuses on population, industries, and policies (Zhou et al., 2018). Additionally, land urbanization, economic urbanization, and social urbanization have also garnered significant attention (Liu et al., 2018). Moreover, due to its pervasive nature within urban systems, the digital economy industry is considered a driving force for urbanization. Therefore, in the information society, urbanization has taken on new meaning. In terms of population urbanization, information and communication technology have brought numerous employment opportunities to urban and rural residents (Qi et al., 2019), significantly promoting labor mobility. The transition of citizens from rural to urban areas is no longer the best indicator of population urbanization. Employment opportunities related to the digital economy attract rural populations to work in their rural areas, helping local governments increase their fiscal income and reduce urban-rural disparities. Land urbanization refers to the moderate and orderly development of urban built-up areas. Lin et al. (2019) argue that the key feature of information and communication technology is the reduction of transaction costs and the improvement of information flow, implying that the boundaries between cities and rural areas are not as distinct. Furthermore, due to the widespread application of information and communication technology in urban planning, urban forms and structures are gradually transforming. Concepts such as mixed and sustainable land use, as well as compact urban planning, have emerged within the context of the digital economy (Bibri et al., 2017). Economic urbanization is a prerequisite for urbanization, and the fact that the digital economy industry promotes economic growth is undeniable. Thus, cultivating new sources of economic growth through the digital economy industry is a reasonable approach. Social urbanization essentially involves raising the overall level of education, healthcare, personal welfare, social security, and the living environment. Information and communication technology is an effective means of promoting social progress. For example, e-learning and telemedicine allow residents in remote areas to access advanced education and healthcare. The widespread use of mobile phones ensures that people, regardless of gender or social status, can access information that was previously inaccessible to them (Bhandari et al., 2019). The concept of the new urbanization process has evolved in light of the digital economy industry.

In summary, this study will assess the impact of digital economy on new urbanization by constructing a comprehensive index consisting of factors related to population, space, economy, and society. We propose the following hypothesis:

Hypothesis 1: The development of the digital economy has a significant positive impact on the construction of new urbanization.

3. Research Design

3.1 Econometric Model Assumptions

To further investigate the role of digital economic development in the construction of new urbanization at the regional level, this study will use panel data from 11 prefecture-level cities in Shanxi Province from 2004 to 2017 to construct an econometric model for specific research on this issue. This will help us gain a more accurate understanding of the relationship between the two and provide targeted guidance and recommendations for regional new urbanization development.

The static econometric model set up in this study is as follows:

$$NUR_{i,t} = \beta_0 + \beta_1 DEI_{i,t} + \beta_c X_{i,t} + \lambda_i + \varepsilon_{it}$$

Where the dependent variable is $NUR_{i,t}$, representing the level of new urbanization in city i in year t. The primary explanatory variable is $DEI_{i,t}$, representing the level of digital economy in city i in year t. $X_{i,t}$ represents a series of control variables that may influence new urbanization. λ_i represents unobservable individual fixed effects for city i. β_0、 β_1、 β_c are the parameters to be estimated. ε_{it} is the random disturbance term.

3.2 Variable Selection

3.2.1 New Urbanization

Regarding the evaluation indicators for new urbanization, scholars have not yet established fixed standards. In general, scholars widely recognize that new urbanization differs from the previous concept of urbanization, which mainly focused on the proportion of urban population in the total population. New urbanization, in addition to considering this aspect, also takes into account various aspects of urban areas, such as their economic, social, and environmental conditions. To ensure the scientific and practical validity of this research, the selection of indicators for new urbanization should consider the following aspects: Firstly, the chosen variables should be comprehensive and representative, capable of adequately reflecting the speed and quality of new urbanization. Secondly, the selection of indicators should be systematic and hierarchical, reflecting various domains of new urbanization development. Lastly, the chosen indicators should be obtainable from reliable sources such as statistical yearbooks and authoritative statistics to ensure data authenticity.

Based on the previous research mentioned and considering the specific social and economic conditions of Shanxi Province, this study has decided to construct a comprehensive indicator system for new urbanization from four dimensions: population urbanization, economic urbanization, spatial urbanization, and social urbanization, as outlined in Table 1.

Table 1: Indicator System for the Level of New Urbanization

	Primary Indicators	Secondary Indicators	Unit
New Urbanization	Population Urbanization	Urbanization Ratio	%
		Population Density	People/square kilometer
	Economic Urbanization	Secondary and Tertiary Industry Value Ratio	%
		Average Urban Employee Compensation	Yuan

		Urban Road Area	Square meters
New Urbanization	Spatial Urbanization	Urban Area Percentage	%
	Social Urbanization	International Internet Users	Ten thousand households
		Hospital and Health Clinic Beds per Ten Thousand People	Sheets/ten thousand people

Population urbanization, unlike traditional urbanization, not only considers the proportion of the urban population but also takes into account other factors. Population urbanization is a critical component of new urbanization and serves as the core manifestation of a region's progress in the entire process. The core concept of new urbanization construction is "people-oriented," and the urbanization rate alone can only reflect the speed and scale of urbanization. Introducing urban population density can provide insight into the living conditions of urban populations and to some extent reflect the quality of urbanization, offering a more comprehensive view of population urbanization.

Economic urbanization serves as the foundation and support of new urbanization, providing continuous impetus for urban development and establishing a solid base for city construction and growth. A region's overall economic situation not only highlights the wealth it produces but also assesses its future social conditions. The ratio of the secondary and tertiary industry's value can roughly reflect the current industrial composition of the city. The average wage level of urban employees can effectively represent the standard of living for urban residents, serving as a key indicator for evaluating the current living conditions of urban residents.

Spatial urbanization reflects the spatial usage of the city. The urban road area of a region roughly indicates the current transportation situation in the city, measuring the convenience of residents' transportation. The percentage of urban area can reflect the development plan and speed of urbanization in the region, evaluating whether the living space for urban residents is sufficient.

Social urbanization is a crucial manifestation of new urbanization, reflecting the current state of life facilities and the level of people's livelihood. The number of international internet users can reflect the level of information technology construction in the city, helping us better understand the communication level of urban residents. The number of hospital and health clinic beds per ten thousand people reflects the medical and health situation in the city, which is closely related to the livelihood of urban residents and is a significant indicator of the standard of living. Both indicators effectively reflect the social development of the city.

3.2.2 Level of Digital Economy

Similarly, scholars have not yet established fixed standards for the composition of indicators for the level of the digital economy. Currently, the measurement of the digital economy mainly includes directly estimating the size of the digital economy and constructing corresponding indicator systems. The construction of digital economy indicator systems is mostly focused on the provincial level. Based on the relevant research mentioned earlier and considering the specific social and economic conditions in Shanxi Province, and taking into account the scientific validity and data availability, this study has decided to construct a specific comprehensive indicator system for the level of new urbanization based on four dimensions: relevant business output, mobile phone penetration rate, industry employees, and internet penetration rate, as outlined in Table 2.

Table 2: Indicator System for the Level of Digital Economy

	Primary Indicators	Secondary Indicators	Unit
Level of Digital Economy Development	Relevant Business Output	Total Telecommunications Business	Ten thousand yuan
	Mobile Phone Penetration Rate	Number of Mobile Phones	Ten thousand households
	Industry Employees	Number of Employees in Information Transmission, Computer Services, and Software Industry	Ten thousand people
	Internet Penetration Rate	Number of International Internet Users	Ten thousand households

This study draws on the methods of Zhao Tao et al. (2020) and Huang Huiqun et al. (2019). Based on the availability of city-level data, the study measures the level of digital economy development at the city level based on the development level of the internet. Internet development is measured from four aspects: internet penetration rate, relevant business output, industry employees, and mobile phone penetration. This indicator system fully considers the talent demand in the development of the digital economy, the business output, and the infrastructure support (the construction of the internet serves as a solid foundation for the rapid development of the digital economy). Given the limited data available at the city level, this indicator system to some extent accurately measures the level of digital economy development in cities.

3.2.3 Control Variables

To comprehensively analyze the role of the digital economy in the process of new urbanization, this study, following the research of Wen Ting et al. (2021), has set control variables that may have an impact on the level of new urbanization. These control variables are as follows:

Economic Strength (GDPPC): Measured using the per capita regional gross domestic product (GDP). A higher value indicates a better overall economic development level in the region. A stronger overall economic strength promotes the advancement of the new urbanization process.

Physical Capital (K): Measured using the amount of fixed asset investment. A higher value implies that the region has invested more in physical capital. The investment in physical capital has a significant impact on the construction of new urbanization in the region. Adequate investment in physical capital provides substantial momentum for the construction of new urbanization, thus significantly improving the region's new urbanization level.

Government Intervention (GOV): Measured using the proportion of general fiscal expenditure to the regional gross domestic product (GDP). A higher proportion of government fiscal expenditure relative to the regional GDP indicates a higher degree of government intervention in the region. To promote economic and social development in the region, the government often employs various industrial policies or fiscal expenditure control measures to intervene in the regional economy, thereby affecting the level of new urbanization in the region.

In summary, the use of each variable in this study is described in Table 3.

Table 3: Variable Descriptions

Variable	Name	Symbol	Expected Effect
Dependent Variable	Level of New Urbanization	NUR	
Independent Variable	Level of Digital Economy	DEI	Positive
	Economic Strength	GDPPC	Positive
Control Variables	Physical Capital	K	Positive
	Government Intervention	GOV	Positive

3.3 Variable Measurement

In the establishment of the composite index, the assignment of weights is a crucial step. Among various methods for weight determination, it varies from person to person, with common methods including equal-weighting, subjective weighting, and principal component analysis. However, these methods often have their shortcomings. This study has chosen a relatively scientific method for weight determination - the Entropy Weighting Method.

The Entropy Weighting Method is widely recognized as a relatively scientific approach for assigning weights. It determines the weights of each variable by using the output entropy of each variable and a fuzzy comprehensive evaluation matrix. This method ensures that even indicators with minimal contributions are not easily excluded. When a variable contains a relatively large amount of useful information, its degree of variation also increases. This means that the weight assigned to that variable also increases, and its role in the evaluation system of the composite index is more significant. This approach can effectively avoid biases introduced by subjective factors, making it widely applied in the field of social sciences.

The implementation of the Entropy Weighting Method generally involves five steps:

1. Standardization of Variables: Since the original data for each variable has significant differences in units, it must undergo dimensionless processing. The formula for standardizing variables is as follows:

$$U'_{ij} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} \quad i = 1, 2, \cdots, m, j = 1, 2, \cdots, n$$

Here, x_{ij} represents the values of the j-th indicator for the i-th prefecture-level city in different years, and U_{ij} represents the dimensionless values of the j-th indicator for the i-th prefecture-level city in different years. To avoid having zero or negative values after standardization, it is common to perform a coordinate shift, which is represented by the formula:

$$U_{ij} = U'_{ij} + 1$$

2. Calculation of Weight for Each Indicator: Calculate the weight P_{ij} for the j-th indicator for the i-th prefecture-level city as follows:

$$P_{ij} = \frac{U_{ij}}{\sum_{i=1}^{m} U_{ij}}$$

3. Calculation of Information Entropy and Redundancy for Each Variable: Calculate the information entropy value E_j and information entropy redundancy F_j for the j-th variable using the following formulas:

$$E_j = -\frac{1}{lnm} \sum_{i=1}^{m} P_{ij} \ln (P_{ij})$$

$$F_j = 1 - E_j$$

4. Calculation of Weight for Each Variable: Calculate the weight W_j for the j-th variable as follows:

$$W_j = \frac{F_j}{\sum_{j=1}^{n} F_j}$$

5. Calculation of Composite Index: Calculate the composite index N_{ij} by combining the weights and standardized values of each variable using the following formula:

$$N_{ij} = \sum_{j=1}^{n} W_j U_{ij}$$

Using the above five steps, different variables are assigned weights, and the composite index for the current stage of new urbanization and digital economic development in Shanxi Province is calculated for use in subsequent empirical research.

4. Results Analysis

4.1 Data Source and Descriptive Statistics

Due to missing data in the urban panel from 2018 to 2020, the sample data for this study spans from 2004 to 2017, with a total sample size of 154, including 11 prefecture-level cities in Shanxi Province. The data used in this study are primarily sourced from the "China Urban Statistical Yearbook," "Shanxi Statistical Yearbook," the National Bureau of Statistics, Shanxi Provincial Bureau of Statistics, and the EPS database.

Index measurements and subsequent regression analyses were conducted using Stata 14.0 software.

The complete econometric model is as follows:

$$NUR_{i,t} = \beta_0 + \beta_1 DEI_{i,t} + \beta_2 GDPPC_{i,t} + \beta_3 K_{i,t} + \beta_4 GOV_{i,t} + \lambda_i + \varepsilon_{it}$$

Based on the panel data of Shanxi Province from 2004 to 2017, the weights for each variable were measured using the Entropy Weighting Method, and the comprehensive indices for new urbanization and digital economic development of the 11 prefecture-level cities in Shanxi Province were calculated by summation, as shown in Tables 4 to 7.

Table 4: Shanxi Province New Urbanization Index 2004-2010

Prefecture-Level City	2004	2005	2006	2007	2008	2009	2010
Taiyuan City	1.074	1.128	1.101	1.102	1.187	1.216	1.418
Datong City	1.195	1.069	1.11	1.148	1.268	1.346	1.423
Yangquan City	1.337	1.447	1.494	1.434	1.265	1.368	1.419
Changzhi City	1.049	1.111	1.153	1.196	1.264	1.311	1.308
Jincheng City	1.304	1.369	1.421	1.33	1.441	1.326	1.367

Table 4: Continued

Shuozhou City	1.069	1.141	1.184	1.329	1.451	1.498	1.505
Jinzhong City	1.177	1.075	1.139	1.16	1.262	1.282	1.374
Yuncheng City	1.130	1.168	1.198	1.217	1.243	1.467	1.49
Xinzhou City	1.067	1.194	1.287	1.29	1.339	1.305	1.362
Linfen City	1.034	1.139	1.177	1.18	1.313	1.251	1.281
Lvliang City	1.047	1.186	1.172	1.214	1.296	1.471	1.409

Table 5: Shanxi Province New Urbanization Index 2011-2017

Prefecture-Level City	2011	2012	2013	2014	2015	2016	2017
Taiyuan City	1.586	1.637	1.839	1.909	1.863	1.907	1.970
Datong City	1.439	1.557	1.639	1.665	1.672	1.665	1.754
Yangquan City	1.437	1.59	1.601	1.595	1.544	1.607	1.641
Changzhi City	1.422	1.587	1.555	1.709	1.722	1.773	1.933
Jincheng City	1.428	1.558	1.592	1.613	1.531	1.579	1.661
Shuozhou City	1.423	1.505	1.456	1.529	1.48	1.628	1.659
Jinzhong City	1.409	1.475	1.552	1.546	1.614	1.703	1.724
Yuncheng City	1.555	1.64	1.671	1.732	1.569	1.563	1.656
Xinzhou City	1.422	1.679	1.719	1.769	1.79	1.727	1.821
Linfen City	1.356	1.425	1.451	1.487	1.536	1.589	1.804
Lvliang City	1.471	1.635	1.663	1.686	1.613	1.679	1.719

Table 6: Shanxi Province Digital Economic Index 2004-2010

Prefecture-Level City	2004	2005	2006	2007	2008	2009	2010
Taiyuan City	1.233	1.302	1.339	1.404	1.423	1.516	1.591
Datong City	1.080	1.123	1.128	1.157	1.174	1.183	1.201
Yangquan City	1.009	1.023	1.027	1.042	1.048	1.066	1.082
Changzhi City	1.045	1.062	1.071	1.098	1.111	1.165	1.179
Jincheng City	1.043	1.049	1.047	1.068	1.079	1.110	1.118
Shuozhou City	1.010	1.020	1.016	1.032	1.056	1.067	1.079
Jinzhong City	1.066	1.080	1.086	1.120	1.128	1.163	1.191
Yuncheng City	1.103	1.108	1.119	1.163	1.200	1.228	1.244
Xinzhou City	1.027	1.076	1.092	1.110	1.132	1.137	1.177
Linfen City	1.080	1.106	1.114	1.149	1.172	1.191	1.240
Lvliang City	1.052	1.084	1.073	1.110	1.148	1.148	1.179

Table 7: Shanxi Province Digital Economic Index 2011-2017

Prefecture-Level City	2011	2012	2013	2014	2015	2016	2017
Taiyuan City	1.587	1.659	1.748	1.790	1.799	1.731	1.850
Datong City	1.180	1.218	1.242	1.245	1.252	1.224	1.270
Yangquan City	1.077	1.097	1.101	1.107	1.111	1.110	1.133
Changzhi City	1.176	1.198	1.214	1.229	1.232	1.219	1.263
Jincheng City	1.110	1.127	1.157	1.162	1.174	1.179	1.196
Shuozhou City	1.073	1.092	1.102	1.105	1.105	1.116	1.135
Jinzhong City	1.186	1.200	1.239	1.232	1.256	1.429	1.271
Yuncheng City	1.209	1.244	1.344	1.323	1.352	1.356	1.409

Xinzhou City	1.165	1.178	1.188	1.194	1.194	1.183	1.222

Table 7: Continued

Linfen City	1.233	1.238	1.286	1.302	1.311	1.318	1.360
Lvliang City	1.151	1.170	1.292	1.233	1.233	1.238	1.277

Descriptive statistics for the main variables in this study are presented in Table 8.

Table 8: Descriptive Statistics of Key Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
NUR	154	1.441	.224	1.034	1.97
DEI	154	1.196	.157	1.009	1.85
GDPPC	154	272.987	143.731	47.65	775.36
K	154	5955.707	4402.849	491.78	20277.1
GOV	154	.171	.061	.075	.353

4.2 Regression Analysis

The regression estimates for the Fixed Effects (FE) and Random Effects (RE) models are presented in Table 9. To determine whether to use the Fixed Effects model or the Random Effects model in the subsequent research, a Hausman test is conducted. Generally, if the result of the Hausman test rejects the null hypothesis, the Fixed Effects model is chosen; otherwise, the Random Effects model is preferred. In this study, the Hausman test for the static panel model yielded a p-value of 0.0000, strongly rejecting the null hypothesis. As a result, the Fixed Effects model is used in the following research.

Table 9: Fixed Effects and Random Effects Regression Results

Variable	(1) FE	(2) RE
dei1	.948***	.251*
	(.177)	(.142)
gdppc1	.001***	.001***
	(0)	(0)
k1	0	0*
	(0)	(0)
gov	1.372***	1.834***
	(.276)	(.274)
_cons	-.13	.546***
	(.162)	(.143)
Observations	154	154
Pseudo R2	.z	.z

Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

Table 10 reports the Fixed Effects model regression results for the impact of the level of digital economy on the level of new urbanization development. Model (1) shows the regression results of the level of the digital economy on the level of new urbanization development without considering other control variables or controlling fixed effects. Model (2) presents the regression results of the level of the digital economy on the level of new urbanization development after including control variables and controlling fixed effects. The results indicate that, whether control variables are included or not, the level of the digital economy has a significant positive impact on the level of new urbanization, confirming Hypothesis 1.

Table 10 Fixed Effects Regression Results of the Impact of the Digital Economy on New Urbanization

Variable	(1) NUR	(2) NUR
DEI	2.188***	.948***
	(.28)	(.177)
GDPPC		.001***
		(0)
K		0
		(0)
GOV		1.372***
		(.276)
_cons	-1.176***	-.13
	(.335)	(.162)
Observations	154	154
R-squared	.764	.85

Robust standard errors are in parentheses

*** p<0.01, ** p<0.05, * p<0.1

From the results of Model (2), we can see that in the Fixed Effects model results with control variables, the indicator for the level of digital economic development (DEI) passes the significance test at the 1% level, with a coefficient of 0.948. This suggests a significant positive effect of digital economic development on the new urbanization level in Shanxi Province, supporting Hypothesis 1. Specifically, for every 1 percentage point increase in the level of the digital economy in Shanxi Province, the new urbanization level increases by 0.948 percentage points.

Among the control variables, the indicator for government intervention (GOV) also passes the significance test at the 1% level, with a coefficient of 1.372. This indicates that government actions have a positive and significant promoting effect on the new urbanization development in Shanxi Province. This positive impact aligns with the prior expectations. Government intervention has a higher effect on regional new urbanization compared to the effect of the digital economic development level. For every 1 percentage point increase in government intervention, the new urbanization development level in the region increases by 1.834 percentage points.

Furthermore, among the control variables, the indicator for economic strength (GDPPC) also passes the significance test at the 1% level, with a coefficient of 0.001. This suggests that economic strength has a positive and significant promoting effect on new urbanization development in Shanxi Province. However, the impact of economic strength on the new urbanization level is relatively small. For every 1 percentage point increase in economic strength, the new urbanization development level in the region increases by 0.001 percentage points.

5. Summary and Prospects

This study is based on panel data and indices spanning 14 years, from 2004 to 2017, for 11 prefectural-level cities in Shanxi Province. It constructs a comprehensive index system for new urbanization, which comprises economic urbanization, social urbanization, spatial urbanization, and demographic urbanization. Utilizing the entropy weight method, the study calculates the new urbanization comprehensive index and the digital economic level index for Shanxi Province. Furthermore, it employs a fixed effects panel data regression model to quantitatively investigate the impact of the level of digital economic development in Shanxi on new urbanization construction. The following conclusions are drawn: (1) The regional level of digital economic development in Shanxi Province has a significant positive effect on new urbanization construction. (2) Regional government intervention in Shanxi Province plays a strong and positive guiding role in the development of new urbanization. (3) The enhancement of the comprehensive economic strength of Shanxi Province has a significant but relatively small impact on new urbanization construction.

Based on these conclusions, the study proposes the following policy recommendations:

Firstly, it is essential to comprehensively promote digital economic development to ensure that digital economy becomes a sustained driving force for guiding new urbanization construction. The baseline regression results demonstrate that the digital economy has a significant positive impact on new urbanization construction, implying that the digital economy is driving new urbanization construction. To fully leverage the driving effect of the digital economy on new urbanization construction, efforts should be made to accelerate the integration of the digital economy with the real economy, enhance the depth and breadth of this integration, and embrace the direction of digitalization, networking, and intelligence. On one hand, this involves promoting digitization in industries such as agriculture, manufacturing, and services, using digital technology to transform and upgrade traditional industries, and improving production and operational efficiency. On the other hand, it requires expediting the training of talents in digital industries such as the internet, computer science, big data, and artificial intelligence, nurturing the development of new digital industries, and strengthening the application of digital technology to expedite the construction of an intelligent production system.

Secondly, regional governments should tailor their efforts to strengthen guidance and supervision of new urbanization construction according to local conditions. Starting from the current state of new urbanization construction in each region, although there have been occasional declines in some years, most of the prefectural-level cities have experienced growth in new urbanization construction over the years. Since 2004, Shanxi Province has made remarkable progress in population urbanization, economic urbanization, spatial urbanization, and social urbanization, with continuous improvements in the level of regional social environments. However, the range of fluctuations in the new urbanization comprehensive index is relatively small, indicating that the current pace of regional new urbanization development is relatively slow. Therefore, it is necessary to continue to adhere to the overall layout of new urbanization construction, known as the "one core, one belt, and three groups," and accelerate the implementation of strategies such as the "big county towns" and the "construction of hundreds of towns." Governments need to increase their guidance by enhancing the reasonable distribution of industries, ensuring capital investment, improving infrastructure, emphasizing landscape and distinctive features, and enhancing total factor productivity to elevate the level of new urbanization construction. In conclusion, the construction of new urbanization in Shanxi Province should not only focus on the capital city's construction but also demand region-specific policy planning to promote digital economic development effectively.

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