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Study on the Impact of Establishing Big Data Comprehensive Pilot Zones on Urban Economic Resilience

Peiyi He

School of Hunan University of Science and Technology, Hunan 411100, China

Abstract: China is currently undergoing a critical transition from old to new growth drivers, with enhancing urban economic resilience emerging as a core imperative for high-quality development. This study employs a natural experiment framework centred on the establishment of national big data comprehensive pilot zones, utilising a sample of 283 prefecture-level and above cities from 2012 to 2023. It employs a difference-in-differences approach to assess policy effects. Findings reveal that the establishment of big data pilot zones significantly enhances urban economic resilience. Mechanism analysis indicates these zones primarily exert influence through talent aggregation and enterprise clustering pathways. Further analysis demonstrates that policy effects are more pronounced in megacities and large cities, as well as in municipalities with robust intellectual property protection and strong policy implementation capacity. Policy recommendations are thus proposed to foster urban economic resilience.

Keywords: Big Data Pilot Zone; Urban Economic Resilience; Difference-in-Differences Method; Factor Agglomeration.

1. Introduction

Cities serve as the core units for economic operations and governance. Their resilience, recovery capacity, and adaptability in the face of shocks determine the foundational robustness of regional high-quality development. At the policy level, the 14th Five-Year Plan, the 20th CPC National Congress, and subsequent central documents have consistently emphasised building resilient cities and enhancing the security of industrial and supply chains. Concurrently, the implementation of the Action Plan for Promoting Big Data Development has spurred the establishment of national big data pilot zones. These zones aim to catalyse digital transformation and upgrade innovation ecosystems by market-oriented allocation of data elements, refinement of regulatory frameworks, and reinforcement of infrastructure. This raises critical questions: Can the creation of big data pilot zones systematically enhance urban economic resilience? What are the operational mechanisms and pathways for realising spatial spillover effects? Do significant differences exist among cities under varying conditions?

Existing research has elucidated the essence of economic resilience from engineering, ecological, and evolutionary perspectives[1,2]. Empirically, it has predominantly measured resilience through single-indicator sensitivity or composite indicator construction, identifying industrial structure, institutional environment, technological innovation, and market conditions as key influencing factors[3,4]. Studies on big data pilot zones have primarily focused on economic outcomes such as digital transformation, innovation output, and industrial upgrading, suggesting that these zones may enhance regional performance by breaking down information barriers, reducing transaction costs, and facilitating factor agglomeration[5,6,7]. A limited number of studies have linked these two domains, finding a positive correlation between digitalisation and resilience[8]. However, three shortcomings remain: firstly, insufficient causal identification and dynamic effect testing between 'big data pilot zones and resilience'; secondly, mechanisms often remain confined to innovation or industrial upgrading, with little direct examination of the critical transmission pathways of 'talent agglomeration and enterprise clustering'; thirdly, a lack of systematic investigation into spatial spillovers and heterogeneity in institutional environments and urban scale.

Compared with existing research, the marginal contribution of this paper lies in the following aspects: firstly, at the theoretical level, it proposes a dual-channel mechanism of 'talent agglomeration-firm agglomeration' and a spatial spillover hypothesis; secondly, methodologically, it constructs an entropy-weighted resilience index based on panel data from 283 cities spanning 2012-2023, identifying net effects through a multi-period difference approach. Spatial DID decomposition is employed to distinguish direct and indirect effects. Third, empirical findings indicate an overall positive policy impact, elucidating the dual-mechanism pathway and identifying more pronounced effects in megacities/large cities, regions with robust intellectual property protection, and areas with higher policy implementation capacity. Concurrently, significant positive spillover effects on neighbouring cities are revealed.

2. Theoretical hypothesis

2.1. Establishment of Big Data Pilot Zones and Urban Economic Resilience

The establishment of big data pilot zones provides systematic impetus across three core dimensions of urban economic resilience.

Regarding resistance, these regions leverage digital technologies to enhance regional information connectivity, thereby mitigating uncertainties in economic activities. By integrating multidimensional data, they achieve precise identification and monitoring of macro-level risks, which not only alleviates the transmission of shocks but also strengthens the economic systems capacity to wit hstand disturbances. Furthermore, data empowers the transformation of traditional industries, fosters emerging industrial clusters, and reduces reliance on single industries. Pilot zones provide information technology support for both government and market operations, dismantling information barriers and reducing decision-making costs to enable more scientific and precise policy responses. Following policy implementation, data facilitates tracking feedback and dynamic adjustments, accelerating the restoration of economic order. Complementary preferential policies accelerate the flow of innovative factors, facilitating rapid industrial restructuring. Regarding adaptability, The digital infrastructure underpinning these pilot zones has generated multiplier effects such as technological diffusion and enhanced regulatory efficiency, stimulating corporate innovation. Data-driven dynamic monitoring and feedback mechanisms have further optimised the economic governance system, rendering policies more flexible and steering the economic system towards a more resilient growth trajectory.

2.2. The Mechanism by Which the Establishment of Big Data Pilot Zones Influences Urban Economic Resilience

According to the theory of complementary capital skills, highly skilled labour exhibits stronger complementarity with physical capital such as digital equipment. By optimising the matching of talent with digital capital, pilot zones provide highly skilled professionals with broader career choices and entrepreneurial opportunities, thereby further attracting scientific and technological talent. Concurrently, the application of big data technologies fosters novel business models, operational paradigms, and job functions, continuously attracting and concentrating technological talent. This clustering effect enhances the synergistic efficiency of production factors, assisting enterprises in accelerating resource allocation and production organisation. This enables cities to swiftly pivot towards critical industries or projects when encountering shocks, thereby strengthening economic resilience. Moreover, the concentration of technological talent generates diverse and differentiated demands, stimulating innovative thinking and technological breakthroughs. This demonstrates greater adaptability and adjustment capacity in the face of economic fluctuations, fostering industrial clusters with enhanced dynamic capabilities. It provides critical support for economic resilience[9].

Wang Linhui et al. note that emerging technologies, exemplified by artificial intelligence, have altered the spatial distribution patterns of enterprises [10]. By offering public data tax incentives and one-stop administrative services, big data pilot zones significantly reduce transaction costs for digital enterprises in information search, negotiation, and oversight processes, while providing access to low-cost resources. This cost reduction, coupled with the spatial concentration effect of resources, drives the clustering of digital enterprises within pilot zones. Furthermore, the aggregation of digital enterprises accelerates cross-sectoral integration and open innovation, propelling technological clusters towards breakthrough development. This simultaneously enhances urban innovation capacity and elevates overall technological reserves and adaptability. Aggregated digital enterprises reduce production costs and improve efficiency through shared public facilities. They also leverage geographical proximity to minimise material and information flow transmission costs between entities, providing cities with stronger output buffering capabilities and thereby enhancing urban economic resilience. Based on the foregoing analysis, the following hypothesis is proposed:

Hypothesis 2: The establishment of big data pilot zones promotes the clustering of technological talent and digital enterprises, thereby enhancing urban economic resilience.

3. Empirical Research Design

3.1. Model Specification

To assess the impact of establishing big data pilot zones on urban economic resilience, this paper constructs a difference-of-differences model. The model specification is as follows:

$$RES_{it} = \beta_0 + \beta_1 DID_{it} + \sum \theta X_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (1)$$

In the aforementioned formula, i denotes a prefecture-level city, t represents the year; RESit is the dependent variable, i.e., the level of economic resilience in region i during year t; β0 is the constant term; β1 represents the policy effect of the Big Data Pilot Zone on urban economic resilience; DIDit is the core explanatory variable, an interaction term between the region dummy variable and the time dummy variable, serving as the policy dummy variable for the establishment of the Big Data Pilot Zone; β1 denotes the coefficient; Xit represents control variables at the urban economic resilience level; μi signifies the fixed effect for region i; γt denotes the time fixed effect for year t; Ɛit represents the random disturbance term in the DID regression model.

3.2. Variable Descriptions

Dependent Variable: Urban Economic Resilience. This study draws upon relevant literature and employs a multidimensional approach to construct a more comprehensive urban economic resilience index. The weights for each indicator were determined using the commonly applied entropy method, as shown in Table 1.

Core explanatory variables: A dummy variable for the establishment of big data pilot zones. The core explanatory variable (DID) in this paper is the product of the regional dummy variable for pilot zone establishment (treat) and the policy implementation time dummy variable (post). In treat, pilot cities where the treatment group policy was implemented are assigned a value of 1, while control groups are assigned 0. In post, the year of policy implementation and subsequent years for pilot regions in the treatment group are assigned a value of 1, with all other years assigned 0.

Control variables: To more accurately analyse the impact of establishing big data pilot zones on urban economic resilience, drawing on existing literature, this study selects: 1) Economic density (EOCDEN): measured by the ratio of GDP to land area; 2) Infrastructure development (TRAFF): measured by the ratio of paved road area at year-end to land area; 3) Degree of government intervention (GOV): measured by the proportion of government expenditure relative to GDP; 4) Foreign Direct Investment (INV): measured by the actual amount of foreign investment utilised; 5) Urban Income Level (SALARY): measured by the average wage of local employees.

Table 1. Evaluation Framework for Urban Economic Resilience Indicators

Primary	Secondary	Measurement
Resistance and Resilience	GDP per capita	GDP/Total Population
	Foreign Trade Dependency	Total Goods Imports and Exports/GDP
	Unemployment Insurance Coverage Rate	Unemployed Insured Persons/Total Population
	Household Savings	Year-End Savings Balance of Urban and Rural Residents/Total Population
	Urbanisation Rate	Urban Population / Total Population
Adaptability and Adjustability	Consumption Capacity	Total Retail Sales of Consumer Goods / GDP
	GDP Growth Rate	(Current Year GDP - Previous Year GDP) / Previous Year GDP
	Fiscal Self-Sufficiency Rate	Fiscal Budget Revenue / Fiscal Budget Expenditure
	Financial Development Level	Year-End Total Deposits and Loans / GDP
	Healthcare Beds	Beds per 10,000 Medical Institutions
Innovation and Transformation Capacity	Education and Science Expenditure Level	Fiscal Education Expenditure + Fiscal Science Expenditure)/GDP
	Industrial Advancement	Value Added of Tertiary Sector/Value Added of Secondary Sector
	Human Capital Level	Higher Education Enrolment per 100,000 Population
	Patent Grants	Number of Patents Granted

3.3. Data Selection and Processing

Based on the completeness of city-level data, a 12-year dataset spanning 2012–2023 from 283 Chinese cities was ultimately selected. The primary sources for this studys data include the Statistical Yearbook of Chinese Cities, the Statistical Yearbook of China, the EPS database, and the Wind Information database. Missing data points were supplemented using municipal statistical bulletins or interpolation methods where necessary. Descriptive statistics are presented in Table 2. Furthermore, multicollinearity tests were conducted on the primary explanatory variables, revealing a maximum VIF value of 2.71. This effectively controlled for the impact of multicollinearity in the regression analysis.

Table 2. Descriptive Statistics for Key Variables

Variables	Abbreviation	Observations	Mean	Std. dev	Min	Max
Virtual Variable for Big Data Pilot Zone	DID	3,396	0.114	0.319	0	1
Urban Economic Resilience	RES	3,396	0.072	0.045	0.022	0.753
Infrastructure Development	TRAFF	3,396	2.853	0.438	0.811	4.096
Economic Density	EOCDEN	3,396	2.740	1.275	1.393	7.451
Government Intervention Level	GOVE	3,396	0.200	0.095	0.044	0.741
Foreign Direct Investment	INV	3,396	2.190	0.809	1.174	4.508
Urban Income Level	SALARY	3,396	1.497	0.426	0.062	3.039

4. Empirical Results Analysis

4.1. Benchmark Regression Analysis

Table 3. Baseline regression results.

Variables	(1)	(2)	(3)	(4)
DID	0.037***	0.011***	0.014***	0.016***
	(0.004)	(0.002)	(0.002)	(0.002)
EOCDEN			0.026***	0.035***
			(0.001)	(0.002)
TRAFF			0.004***	0.001***
			(0.001)	(0.000)
GOVE			0.033***	0.026***
			(0.008)	(0.007)
INV			-0.004	-0.006***
			(0.001)	(0.002)
SALAR			0.028***	0.018***
			(0.002)	(0.003)
Constant	0.072***	0.075***	-0.065***	-0.011
	(0.001)	(0.000)	(0.007)	(0.009)
City FE	NO	YES	NO	YES
Year FE	NO	YES	NO	YES
Observations	3,396	3,396	3,396	3,396
R-squared	0.069	0.873	0.570	0.882

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

This study employs the Difference-in-Differences (DID) approach for benchmark regression analysis, with specific results presented in Table 3. The DID coefficients for the core explanatory variable demonstrate a significant positive effect across Models (1) to (4). This indicates that establishing big data pilot zones significantly enhances urban economic resilience. This validates Hypothesis 1.

4.2. Parallel Trends Test and Dynamic Effects Analysis

This study employs an event study methodology to examine parallel trends prior to policy implementation and to test dynamic effects post-implementation. The model specification is as follows:

$$RES_{it} = \alpha_0 + \sum_{k=-4}^{7} \alpha_t D_t + \sum \theta X_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (2)$$

Dt denotes the annual dummy variable before and after policy implementation, while αt is the coefficient of interest, which characterises whether the RES of the experimental and control groups exhibited parallel trends prior to the establishment of the big data pilot zones. This study selected the period immediately preceding the policy as the baseline. The parallel trend test revealed that αt coefficients were non-significant in the pre-policy periods. However, following the implementation of the pilot zone policy, the αt coefficient is significantly positive. This indicates that prior to the establishment of the big data pilot zones, the urban economic resilience levels of the experimental and control groups exhibited similar operational trends. The ex-ante parallel trend hypothesis is not rejected, objectively reflecting the validity of the double difference model design employed in this study. The assessment results for the parallel trend hypothesis are presented in Figure 1 below:

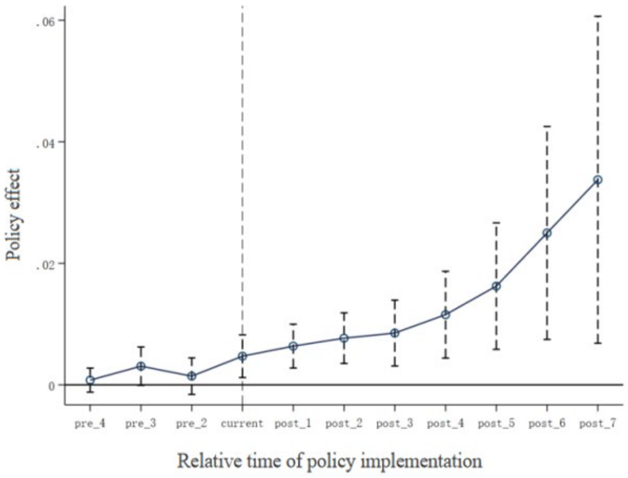

Figure 1. Parallel trend hypothesis test

4.3. Robustness Tests

4.3.1. Placebo Test

This study further employs a placebo test: an equal number of cities are randomly selected from the sample data to form a virtual treatment group, with the remaining cities serving as a virtual control group. This yields coefficient estimates for the comprehensive big data pilot policy implemented in the cities, assessing its impact on urban economic resilience. The experimental process is repeated 500 times, generating 500 sets of regression coefficients and their corresponding p-values. Figure 2 illustrates the distribution of regression coefficients and p-values in the placebo test. The regression coefficients predominantly clustered around zero and exhibited a normal distribution, with the majority of estimated p-values exceeding 0.1. The benchmark regression models observed value of 0.002 occupied a tail position within the placebo tests regression coefficient distribution. This indicates that the estimated value is unlikely to have arisen from random factors, thereby enhancing the robustness of the research conclusions.

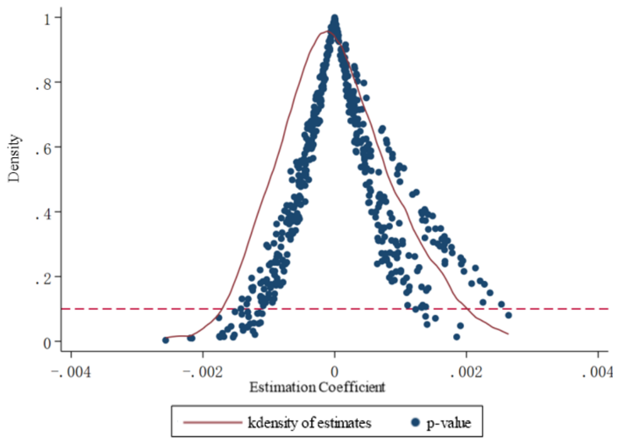

Figure 2. Placebo test

4.3.2. Addressing Sample Selection Bias

To mitigate endogeneity issues arising from sample selection bias, this study employs propensity score matching combined with the difference-in-differences approach for validation. The methodology is as follows: control variables identified in the preliminary stage are selected as matching variables. Subsequently, an annual matching method is used to determine the control group for the treatment group, followed by common support tests and balance tests. Table 4 presents the regression results based on the PSM-DID model. To ensure the accuracy of the matched regression results, this study excluded unmatched samples and solely utilised successfully matched samples to estimate the impact of big data pilot zones on urban economic resilience. The specific findings indicate that big data pilot zones still significantly promote the enhancement of urban economic resilience levels, demonstrating the robust validity of this papers empirical conclusions.

4.3.3. Instrumental Variables Method

This paper adopts the methodology of Fan Yuanyuan and Li Jianjun[11], employing the interaction term (iv) – calculated by multiplying each citys 1984 fixed telephone lines per hundred inhabitants by the previous years national internet users (in millions) – as an instrumental variable. The rationale is that pilot zone development relies on robust digital infrastructure. Historical telecommunications infrastructure may influence pilot site selection decisions through technological and behavioural factors, thus satisfying the requirement for causality. Moreover, the declining frequency of fixed-line telephone usage renders its impact on urban economic resilience negligible, thus satisfying the exogeneity requirement. Table 4 presents the results of the two-stage least squares estimation. The regression analysis demonstrates a significant correlation between the instrumental variable and the pilot policy variable. Furthermore, the instrumental variable passes the weak instrumental variable test, validating its effectiveness and thereby confirming the reliability of the aforementioned conclusions.

Table 4. Endogeneity test

Variables	(1)	(2)	(3)
	PSM-DID	DID	RES
DID	0.006***		0.123***
	(0.002)		(0.020)
IV		0.303***	
		(0.035)	
Kleibergen-Paap rk LM			52.933***
Kleibergen-Paap rk Wald F statistic			72.860[16.38]
Controls	YES	YES	YES
City FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	3,396	3,396	3,396
R-squared	0.917	0.263	0.654

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Within [] is the cut-off value of the 10% level of the Stock-Yogo test.

5. Further Analysis

5.1. Testing the Mechanism of Action

This paper further explores the mechanisms through which the establishment of big data pilot zones enhances urban economic resilience. Specifically, the following regression equations were constructed:

$$M_{\text{it}} = \beta_0 + \beta_1 DID_{it} + \sum \theta X_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (3)$$

Mit denotes the mechanism variable, with all other settings consistent with the baseline regression model.

Table 5. Results of the mechanism of action test.

Variables	(1)	(4)
	Talent pool	Enterprise clustering
DID	0.011***	0.204***
	(0.001)	(0.038)
Controls	YES	YES
City FE	YES	YES
Year FE	YES	YES
Observations	3,396	3,396
R-squared	0.685	0.898

Note: Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

The establishment of big data pilot zones has facilitated the clustering of scientific and technological talent alongside digital enterprises, thereby enhancing urban economic resilience. To evaluate this mechanism: ① The proportion of personnel employed in scientific research and technical services, geological exploration, information transmission, computer services, and software development relative to total urban employment was selected as a proxy variable for scientific and technological talent clustering[12]; ② Enterprise registration data from 2012 to 2023 was obtained via the industrial and commercial administration website. This dataset primarily includes enterprise name, type, registered location, registration date, registered capital, and principal business activities. By aggregating city-year data, the annual number of newly registered enterprises in the information transmission, software, and information technology services sector (log-transformed) was calculated for each city, serving as a measure of digital enterprise concentration[13]. The regression results are presented in Table 5 The difference coefficients for both scientific talent agglomeration and digital enterprise agglomeration were significantly positive at the 1% significance level, indicating that big data pilot zones can promote the clustering of scientific talent and digital enterprises, thereby enhancing economic resilience.

5.2. Heterogeneity Testing

For research centred on cities, examining the heterogeneous impacts of big data policies across different urban areas holds significant practical relevance.

5.2.1. Heterogeneity in Urban Scale

Significant baseline differences exist among Chinas prefecture-level cities, potentially introducing heterogeneous characteristics in the relationship between big data pilot zones and economic resilience. This paper therefore analyses how urban scale influences the effectiveness of digital governance in enhancing economic resilience. In accordance with the 2014 State Council Notice on Adjusting the Classification Standards for Urban Sizes, the sample was categorised into five tiers: megacities, large cities, medium-sized cities, and small cities. By establishing dummy variables for each tier, regression analysis was conducted between the dependent variable DID and each dummy variable to examine the impact of big data pilot zones on the economic resilience of cities of varying scales. The regression results are presented in Table 6. Only the regression coefficients for the triple difference terms in columns (4) and (5) are significantly positive at the 10% and 1% significance levels, respectively. This indicates that the positive impact of establishing big data pilot zones on urban economic resilience is evident only in megacities and super-large cities. This is because larger cities possess more abundant talent and enterprise resources, as well as more developed educational environments and entrepreneurial atmospheres, thereby providing soft power support for the development of big data technologies.

Table 6. Regression Results for Urban Scale Heterogeneity

Variables	(1)	(2)	(3)	(4)	(5)
DID_SMALL	-0.003				
	(0.003)				
DID_MEDIUM		-0.005			
		(0.003)			
DID_LARGE			-0.006		
			(0.005)		
DID_EXTRALARGE				0.008*	
				(0.004)	
DID_SUPERLARGE					0.061***
					(0.009)
Controls	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Observations	3,396	3,396	3,396	3,396	3,396
R-squared	0.883	0.884	0.883	0.883	0.891

Note: Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

5.2.2. Heterogeneity in Institutional Environments

Policy implementation capacity. The smooth execution and implementation of policies constitute a fundamental prerequisite for enhancing economic resilience through big data pilot zones[14]. Digital government transforms policy implementation actions and outcomes into data-driven information, enabling both effective oversight of the implementation process and scientific evaluation of policy effectiveness. To this end, this paper adopts the methodology proposed by Wang Fengzheng and Liu Ximeng[15], constructing a dummy variable DIG based on the comprehensive e-government pilot selection initiative jointly conducted by the Cyberspace Administration of China and the National Development and Reform Commission in late 2017. In Column (1) of Table 7, the DID_DIG results exhibit a significant positive correlation at the 1% significance level, indicating that cities with stronger policy implementation capabilities derive greater resilience effects from the big data pilot zone policy.

Intellectual property protection intensity. This study employs data from the 2012 National Intellectual Property Administration selection of national intellectual property demonstration cities to construct the dummy variable IPP. If a city was designated an intellectual property demonstration city in a given year, IPP is assigned a value of 1 for that year and subsequent years; otherwise, it is 0. Column (2) of Table 7 shows that DID_IPP is significantly positive at the 1% level. This indicates that, after controlling for key confounding factors, the resilience-enhancing effect of big data pilot zones is significantly positive in groups with higher levels of innovation-friendly legal environments. Consequently, a robust innovation-friendly legal environment elevates the citys overall innovation climate, stimulating the innovative dynamism of big data pilot zones and enabling them to deliver superior resilience-enhancing efficacy.

Table 7. Institutional Environment Heterogeneity

Variables	(1)	(2)
DID_HUMAN		
DID_DIG	0.033***	
	(0.006)	
DID_IPP		0.015***
		(0.005)
Controls	YES	YES
City FE	YES	YES
Year FE	YES	YES
Observations	3,396	3,396
R-squared	0.888	0.886

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6. Conclusions and Policy Recommendations

This study constructs an indicator system based on evolutionary resilience theory, employing entropy weighting and a double difference model to empirically examine the impact of big data pilot zones on urban economic resilience from 2012 to 2023. Findings indicate that establishing pilot zones significantly enhances urban economic resilience, with robust conclusions. This effect exhibits heterogeneity: it is more pronounced in megacities, cities with high digital literacy, and those with superior institutional environments (such as intellectual property protection). Mechanism analysis reveals that pilot zones primarily strengthen cities resilience and recovery capacity through two pathways: attracting clusters of scientific and technological talent and fostering concentrations of digital enterprises, thereby elevating economic resilience. Consequently, this paper proposes the following policy recommendations:

First, persistently deepen the development of comprehensive big data pilot zones. Establish unified expansion criteria at the national level, prioritising cities with weak foundations and urgent transformation needs, while creating mechanisms to disseminate replicable models. Address initial-stage shortcomings by refining talent support systems and facilitating factor mobility. Implement targeted investment promotion for enterprises, offering bundled incentives to leading firms and incubation support to start-ups, while mapping industrial chains to foster collaborative clusters. Simultaneously, cultivate distinctive digital industries based on regional endowments, guide traditional enterprises in intelligent transformation, and accelerate the development of industry-academia-research platforms to facilitate precise alignment between technological R&D and industrial demands.

Second, implement differentiated policies tailored to local conditions alongside infrastructure support. For the better-equipped central regions, offer fiscal incentives to attract talent and guide the transfer of emerging industries from the east. For the less developed western regions, prioritise strengthening transport and information infrastructure, nurture distinctive industries, and enhance talent support systems. Concurrently, bridge the digital divide by upgrading networks and skills in lagging areas, and disseminate advanced achievements through university-enterprise collaborations. Through integrated fiscal, financial, and regional cooperation measures, the resilience of central and western regions can be effectively enhanced, driving balanced national development.

Thirdly, promote cross-regional digital factor mobility and establish collaborative innovation governance mechanisms. Establish pilot zone coordination teams and communication platforms to unify data property rights, transaction, and security standards, implementing cross-regional circulation 'whitelists'. Deepen reforms to streamline administration, delegate powers, and improve services, dismantling barriers to factor mobility while enhancing industry-academia-research platforms and financing channels. Coordinate planning for critical digital infrastructure such as 5G networks and computing centres, promoting cross-regional co-construction, shared use, and integrated operation and maintenance. Support the establishment of regional industrial internet and data sharing centres, opening them to neighbouring areas. Refine policies for mutual recognition of professional qualifications, shared use of research outcomes, and cross-regional capital flows. Establish regional talent markets and technology exchange platforms to facilitate efficient allocation of innovation factors through multi-stakeholder collaboration, forming a development pattern characterised by 'core-led, periphery-radiating' growth.

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