

Digital Infrastructure Development and Entrepreneurial Activity: Evidence from Chinese Cities

Lulu Yuan *

School of Economics, Anhui University of Finance and Economics, 233000, Bengbu, Anhui, China

* Corresponding author: Lulu Yuan (Email: 20220977@aufe.edu.cn)

Abstract: Digital infrastructure development can activate regional entrepreneurial vitality through dual pathways of credit empowerment and service penetration. Based on panel data from 31 provincial regions in China between 2013 and 2022, this paper systematically evaluates the impact of digital infrastructure construction on regional entrepreneurial activity. The study finds that digital infrastructure construction significantly enhances regional entrepreneurial activity, a conclusion supported by a series of robustness tests. Mechanism verification reveals that the coverage breadth of digital inclusive finance serves as a crucial channel for stimulating entrepreneurial vitality through digital infrastructure development; meanwhile, market efficiency exerts a negative moderating effect between digital infrastructure construction and entrepreneurial activity. Additionally, its promoting effects exhibit significant regional disparities, with particularly pronounced impacts observed in eastern China.

Keywords: Digital infrastructure construction; Entrepreneurial activity; Digital financial coverage breadth index; Marketization degree.

1. Introduction

Entrepreneurial activity, as a core indicator measuring an economy's innovation vitality and employment absorption capacity, has seen its strategic importance increasingly highlighted at the national level. China's 14th Five-Year Plan and the Long-Range Objectives Through 2035 explicitly propose to stimulate the vitality of all market entities, create a market-oriented, law-based, and internationalized business environment, and position entrepreneurship as one of the core engines for achieving high-quality development and promoting common prosperity. Entrepreneurship is essentially the creative reorganization of production factors (Schumpeter, 1934) [1], driving economic growth through technology commercialization (Bai Junhong et al., 2022) [2]. However, China's current entrepreneurial activity faces dual challenges: high environmental uncertainty leads enterprises to reduce innovation investments (Li Xuesong et al., 2010) [3], while traditional factor market barriers continue to constrain entrepreneurial vitality (Cai Fang, 2020) [4]. Enhancing entrepreneurial activity and effectively addressing key obstacles in the entrepreneurial process have become pressing practical issues that need urgent resolution to realize the national innovation-driven development strategy.

In this context, digital infrastructure, as the "foundation" and "cornerstone" supporting the digital transformation of the economy and society, has increasingly demonstrated its strategic value and is highly anticipated to become a key force empowering entrepreneurship and stimulating vitality. In 2023, the Central Committee of the Communist Party of China and the State Council issued the "Overall Layout Plan for Digital China Construction", which represents a strategic deployment to proactively address the new global landscape of digital competition, systematically unleash the value of data elements, and comprehensively build new advantages for development in the digital era. Powerful digital infrastructure, by significantly reducing information acquisition and dissemination costs, providing inclusive and efficient digital tools and services, and optimizing market connectivity and

resource allocation efficiency, is expected to fundamentally reshape the entrepreneurial ecosystem. This provides a robust foundational support for entrepreneurs to overcome traditional barriers, identify and seize new opportunities, and enhance their success rates in entrepreneurship (Guo Kaiming et al., 2021 [5]; Wang Ke and Chao Xiaojing, 2023 [6]). Essentially, digital infrastructure, through its powerful "connection", "empowerment", and "enabling" characteristics, offers innovative technical pathways and possibilities for addressing core pain points that constrain entrepreneurial opportunities.

Current academic discussions on factors influencing entrepreneurial activity have reached considerable richness. While exploring multidimensional pathways including institutional environment (Zhou Xiaogang et al., 2025) [7], financial support (Huang Yuanbiao et al., 2024) [8], and digital technology empowerment (Bie Chaoxia et al., 2025) [9], most studies tend to treat digital technology as an exogenous environmental variable, failing to thoroughly analyze its core enabling function of "digital infrastructure" - the foundational carrier - or its internal mechanisms. To address this gap, this paper adopts a provincial macro-level perspective. After synthesizing relevant literature, we first theoretically elucidate the pathway through which digital infrastructure development impacts entrepreneurial activity. Subsequently, empirical analysis demonstrates the significant and robust promoting effect of digital infrastructure construction on regional entrepreneurial activity, while examining its mechanisms, mediating effects, and moderating effects. Finally, based on empirical findings, we propose policy recommendations to strengthen digital infrastructure support and enhance regional entrepreneurial activity.

This study makes four key contributions: First, it systematically examines the theoretical mechanisms through which digital infrastructure development influences regional entrepreneurial activity, building upon existing research on entrepreneurial determinants. Second, empirical analysis demonstrates the direct and robust effects of digital infrastructure on entrepreneurial vitality, revealing its

operational pathways. Third, the study identifies partial mediating effects from the coverage of digital inclusive finance and a negative moderating effect from regional marketization levels, deepening our understanding of mechanism complexity. Fourth, regional heterogeneity analysis highlights significant variations in digital infrastructure's stimulating effects across different areas, providing targeted recommendations for optimizing regional digital infrastructure deployment to maximize entrepreneurial spillover effects.

2. Review of the Literature

2.1. Research on Entrepreneurial Activity

Entrepreneurial activity serves as a vital cornerstone for maintaining regional employment stability and nurturing innovative momentum (Xu Wenhuan, 2023) [10], while also acting as the core engine driving high-quality economic development. Existing literature on determinants of entrepreneurship has extensively explored two dimensions: micro-level entrepreneurial actors and macro-level environments. At the macro level, various environmental factors profoundly influence the scale, quality, and direction of entrepreneurial activities by affecting the generation of opportunities, resource acquisition, and cost-benefit structures. These include institutional environments and business ecosystems (Lin Xiaowen, 2024 [11]; Jin Huan, 2024 [12]), incentive policies (Tan Weijie, 2024) [13], sociocultural atmosphere (Mei Hong, 2024) [14], key factor costs such as housing prices (Wu Xiaoyu et al., 2014) [15], population mobility and spatial agglomeration (Ye Wenping et al., 2018 [16][17]; Yu Xiao and Xu Yingdong, 2022 [18]), and talent resource concentration (Tan Yanzhi, 2025) [19]. Additionally, the development of the digital economy influences entrepreneurs' decision-making behaviors from both supply-side and demand-side perspectives, thereby enhancing urban entrepreneurial activity (Jiang Hao, 2024) [20]. Notably, the vigorous rise of the digital economy, with its high permeability, strong connectivity, and significant external economic characteristics, is reshaping the entrepreneurial ecosystem at an unprecedented depth and breadth. It profoundly influences entrepreneurs' decisions from both supply and demand sides (Jiang Hao, 2024) [20]. More importantly, by fostering new industrial forms, providing massive information and technical support (Zhao Yunhui et al., 2019) [21], and empowering governments to enhance governance efficiency and enterprise service capabilities (He Yuke et al., 2024) [22], it generates strong momentum for stimulating mass entrepreneurship and promoting high-quality development of startups (Zhao Tao et al., 2020) [23].

2.2. Research on Digital Infrastructure Construction

Existing literature primarily conducts qualitative discussions on the resource allocation function and technological attributes of digital infrastructure from the perspectives of techno-economic analysis and innovation diffusion theory (Czemich et al., 2011 [24]; Ji Jie et al., 2023 [25]), emphasizing its role in reducing social transaction costs and restructuring production factor distribution patterns by providing high-speed networks, computational power support, and data circulation capabilities. Subsequently, scholars have quantitatively examined the direct impact of digital

infrastructure on entrepreneurial activities through quasi-natural experiment methods: Empirical studies based on African submarine cable deployment found that network coverage increased service-oriented entrepreneurship rates by 9.5%, particularly promoting individual entrepreneurship and small business establishment (Hjort & Poulsen, 2019) [26]; The "Broadband China" pilot policy significantly enhanced cities' attractiveness to high-skilled entrepreneurial talents from outside, stimulating urban inflows of such talents through digital entrepreneurship resources (Jiao Hao, 2023) [27].

Digital infrastructure also stimulates entrepreneurial activities by alleviating financing constraints. A 1-standard-deviation increase in mobile payment coverage boosts the probability of start-ups obtaining credit by 18.3%, primarily attributed to digital credit systems reducing information asymmetry between banks and enterprises (Guo Feng et al., 2020) [28]. Notably, this effect shows significant industry heterogeneity--with e-commerce startups benefiting 23.1% more strongly than traditional retail (6.4%), indicating that industries with higher digitalization levels are better equipped to overcome geographical limitations (Xiao Chunmei, 2023) [29]. However, no studies have systematically explored the differential mechanisms and moderating effects of digital infrastructure on workers' entrepreneurial outcomes. Wang Xiaoxiao et al. (2021) [30], based on corporate innovation data, suggested that digital infrastructure promotes innovation through optimized supply chain coordination and accelerated technology diffusion. Whether this pathway applies equally to grassroots entrepreneurs remains to be verified.

While the positive impact of digital economy on entrepreneurial activities has gained widespread academic recognition, providing logical references and theoretical foundations for related research, existing studies still exhibit key limitations from a research perspective. First, there is limited exploration of how digital infrastructure development directly affects the construction of robust entrepreneurial ecosystems and stimulates regional entrepreneurial vitality. Second, the boundary conditions and moderating factors influencing regional entrepreneurial activity through digital infrastructure remain underexplored. Third, insufficient attention has been paid to the heterogeneous characteristics of digital infrastructure's effects on entrepreneurial activity across different regions, making it difficult to explain regional disparities in policy effectiveness. The development of digital infrastructure centered on intelligent technologies can provide foundational support for regional entrepreneurial ecosystems, thereby unleashing latent economic potential. Based on provincial panel data from 31 Chinese provinces spanning 2013 to 2022, this study systematically investigates the impact and spatial heterogeneity of digital infrastructure development on regional entrepreneurial activity, while further examining the moderating role of regional marketization levels and the mediating mechanism of digital inclusive finance coverage.

3. Analysis and Hypotheses

3.1. The Direct Impact of Digital Infrastructure Construction on Regional Entrepreneurial Activity

As a pivotal production factor in the digital economy, digital infrastructure significantly lowers entrepreneurial barriers and expands market boundaries through its high-

speed connectivity and ubiquitous coverage, creating new pathways to stimulate regional innovation. First, the widespread adoption effect reduces startup costs. Cutting-edge networks and cloud computing revolutionize traditional resource acquisition: cloud platforms provide affordable computing power and software services, enabling entrepreneurs to access powerful computational capabilities without heavy hardware investments. Simultaneously, these technologies enhance information efficiency, allowing startups to obtain market intelligence and policy updates at minimal cost while streamlining data management through digital tools. Second, network effects expand corporate market reach by breaking geographical constraints. Digital infrastructure eliminates regional barriers, enabling entrepreneurs to directly engage global customers via e-commerce and social media for precise demand matching. Furthermore, it "shortens" transaction distances, facilitating real-time online transactions and service delivery.

Based on the above theoretical analysis, this paper puts forward the following hypotheses.

H1: Digital infrastructure construction has a significant positive effect on regional entrepreneurial activity.

3.2. The Indirect Impact of Digital Infrastructure Construction on Regional Entrepreneurial Activity

The expansion of digital inclusive finance coverage has significantly boosted regional entrepreneurial vitality. Digital infrastructure enhances financial service accessibility by reducing information asymmetry and geographical barriers, enabling precise allocation of financial resources to empower startups. Firstly, accurate credit profiling improves resource efficiency. Dynamic credit evaluation models utilizing big data and cloud computing integrate diverse enterprise data including electricity usage and logistics operations, bridging information gaps between asset-light entrepreneurs and financial institutions while alleviating financing constraints and expanding coverage. Secondly, financial services are extended to underserved areas through mobile payments and smart investment platforms that transcend physical boundaries in county markets, enhancing basic financial service accessibility. The widespread availability and efficient allocation of financial resources form the foundation for stimulating entrepreneurial dynamism. Traditional financial barriers to small businesses' financing have created exclusionary risks that hinder entrepreneurial activity. Inclusive finance theory emphasizes that upgrading digital infrastructure can reduce service costs and risks, thereby easing entrepreneurial financing constraints.

Based on the above theoretical analysis, this paper puts forward the following hypotheses.

H2: Digital infrastructure construction indirectly improves regional entrepreneurial activity by improving the coverage of digital inclusive finance.

3.3. The Efficient Market Has a Moderating Effect on The Impact of Digital Infrastructure Construction on Regional Entrepreneurial Activity

The marketization process regulates the entrepreneurial activation effect of digital infrastructure by altering institutional environments and resource allocation rules. Firstly, marketization may intensify resource concentration

that compresses startup opportunities. In highly marketized regions, resources rapidly converge toward efficient entities. Leading enterprises leverage advantages in data and capital to establish market barriers, raising entry thresholds and squeezing out startups. Secondly, marketization may weaken policy guidance and deviate from inclusive objectives. Highly marketized areas reduce government intervention, with private sectors dominating digital infrastructure operations. Without proper regulation, profit-driven capital may tilt services toward high-value regions, deviating from the original goal of inclusive entrepreneurship. A healthy market environment should promote efficient resource allocation and entrepreneurial vitality, but when marketization exceeds critical thresholds, excessive resource concentration and diluted policy goals undermine the inclusiveness and entrepreneurial activation functions of digital infrastructure. Studies show that when the marketization index surpasses a specific threshold, the marginal effect of digital infrastructure on high-tech industry innovation performance declines (Fu Jianru, 2023) [31]. This indicates that competition compression and policy dilution under high marketization may hinder the penetration of digital infrastructure dividends to broader entrepreneurial entities.

Based on the above analysis, this paper proposes the following hypotheses.

H3: With the improvement of marketization level, the promoting effect of digital infrastructure construction on entrepreneurial activity is gradually weakened, and may even have a weakening effect.

4. Research Design

4.1. Data Sources

This paper selects panel data from 31 provinces in China between 2013 and 2022 as the research subject, collecting a total of 310 samples. The research data sources include the China Statistical Yearbook, regional statistical yearbooks, EPS database, the National Bureau of Statistics website, the Peking University Digital Financial Inclusion Index (2011-2022), and other official websites. Ultimately, 3,410 observations were obtained.

4.2. Variable Selection and Explanation

4.2.1. Dependent Variable: Entrepreneurial Activity (Entre)

This study utilizes data from the China National Data Center (CNRDS) as a key indicator to quantify regional entrepreneurial activity. When examining the specific contributions of digital infrastructure development to regional entrepreneurship, this dataset is employed as an explanatory variable where higher values indicate more frequent entrepreneurial activities in the region.

4.2.2. Core Explanatory Variable: Digital Infrastructure Construction (Dig)

This paper uses the number of Internet broadband access ports per capita to measure the improvement degree of digital infrastructure construction in various regions. This data can objectively reflect the coverage level and basic carrying capacity of regional digital infrastructure.

4.2.3. Control Variables

Beyond the core explanatory variable of digital infrastructure development, multiple factors influence regional entrepreneurial activity. Building on Kang Maonan et al. (2025) [32], this study selects the following control

variables: Economic Development Level (lngdp) measured by the logarithm of per capita GDP; Education Level (edu) assessed by the proportion of higher education enrollees; Openness (open) calculated as the ratio of import-export trade volume to GDP; Scientific Development Level (sci) determined by the ratio of regional scientific fiscal expenditure to general fiscal expenditure; Population Agglomeration (lnpop) gauged by the logarithm of urban population density; Industrialization Level (ind) measured by the ratio of secondary industry value-added to GDP; Environmental Protection (env) evaluated by the proportion of industrial pollution control investment to GDP.

4.2.4. Mediating Variables

This paper draws lessons from Lu Yuan (2024) [33] and takes the coverage breadth of sub-indicators of digital inclusive finance index as a mediating variable.

The coverage breadth of digital inclusive finance. Based on data released by the Digital Inclusive Finance Research Center at Peking University, this study explores the impact

mechanism of digital infrastructure development on entrepreneurial vitality. The improvement in the digital inclusive finance coverage index can expand financial service accessibility, alleviate information asymmetry issues, thereby enhancing financing accessibility for small and micro enterprises. This indirectly optimizes capital acquisition channels for entrepreneurs and provides financial infrastructure support for cultivating regional entrepreneurial ecosystems.

4.2.5. Moderating Variables

This paper draws on the approach of Jiang Hao et al. (2024) [20], using the efficient market as a moderating variable. Based on the data published in the "China Provincial Marketization Index Report", marketization level is selected as the measurement indicator. An efficient market can create a favorable external environment for the improvement of digital infrastructure, thereby exerting its radiating and driving effects on entrepreneurial activities. The descriptive statistics of relevant variables are shown in Table 1.

Table 1. Descriptive statistics

Variable name	Sample Capacity	Mean	SD	Least Value	Crest Value
Entre	310	9.287	0.299	8.539	10.43
Dig	310	0.555	0.217	0.136	1.075
lngdp	310	10.96	0.428	10.05	12.16
edu	310	0.0914	0.0105	0.0525	0.122
open	310	0.248	0.260	0.00764	1.348
sci	310	0.0218	0.0155	0.00303	0.0676
lnpop	310	7.905	0.389	6.965	8.620
ind	310	0.382	0.0817	0.159	0.547
env	310	0.0437	0.0289	0.00530	0.185
Market	310	8.140	2.193	-0.161	12.86
Coverage	310	-3.41e-09	1.000	-2.129	2.249

5. Model Building

5.1. Benchmark Regression Model

$$\text{Entre}_{it} = \alpha_0 + \alpha_1 \text{Dig}_{it} + \gamma \Sigma \text{Controls}_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (1)$$

Entre denotes entrepreneurial activity, Dig represents the completeness of digital infrastructure development, $\Sigma \text{Controls}_{it}$ indicates the set of control variables, α_0 denotes the constant term, γ used to represent the coefficient of the relationship between digital infrastructure development and entrepreneurial activity. μ_i represents individual fixed effects, θ_t denotes time fixed effects, ε and ε_i denotes random disturbance terms. The subscript i stands for individual (provinces), and t represents time (2013–2022). This study focuses on examining the significance of coefficient α_1 ; when α_1 is significantly positive, it indicates that digital infrastructure development can effectively enhance entrepreneurial activity.

5.2. Mediation Model

In order to further explore the research objectives, this paper studies the mediating role of digital inclusive finance coverage in the benchmark regression model. The model is established as follows:

$$\text{Entre}_{it} = \alpha_0 + \alpha_1 \text{Dig}_{it} + \gamma \Sigma \text{Controls}_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (2)$$

$$\text{Med}_{it} = \beta_0 + \beta_1 \text{Dig}_{it} + \gamma \Sigma \text{Controls}_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (3)$$

$$\text{Entre}_{it} = \lambda_0 + \lambda_1 \text{Dig}_{it} + \lambda_2 \text{Med}_{it} + \gamma \Sigma \text{Controls}_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (4)$$

Among them, Med_{it} is the mediating variable, which is set as the digital inclusive finance coverage breadth index in this paper. The data are standardized and ε_{it} is the random disturbance term.

5.3. The Moderating Effect Model

This paper aims to deeply analyze how the progress of digital infrastructure construction affects entrepreneurial activity, and on the basis of benchmark regression analysis, take efficient market as a moderating variable to test its moderating role in the process of digital infrastructure construction promoting entrepreneurial activity. The model is constructed as follows:

$$\text{Entre}_{it} = \alpha_0 + \alpha_1 \text{Dig}_{it} + \alpha_2 \text{Market}_{it} + \alpha_3 \text{Dig}_{it} \times \text{Market}_{it} + \gamma \Sigma \text{Controls}_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (5)$$

Market_{it} represents the efficient market, $\text{Dig}_{it} \times \text{Market}_{it}$ represents the interaction term between digital infrastructure construction and moderating variables. α_3 reflects the direction and degree of the moderating effect, α_0 is the intercept variable, α_0 , α_1 and α_2 are the estimated coefficients to be estimated in the model, and the meanings of other symbols are the same as those in Equation (1).

6. Empirical Results and Analysis

6.1. Benchmark Regression Analysis

Table 2 presents the stepwise regression results examining the impact of digital infrastructure development on entrepreneurial activity. Column (1) incorporates core explanatory variables, years, and individual fixed effects to control for time-and region-dependent variations. Column (2) adds control variables to the first column. The analysis demonstrates that digital infrastructure development maintains a significant positive effect on entrepreneurial activity regardless of whether control variables are included. This indicates that improved digital infrastructure can enhance urban entrepreneurial vitality, thereby validating Hypothesis H1.

Table 2. Benchmark regression

Variable	(1)	(2)
	Entre	
Dig	0.332*	0.603***
	(1.76)	(3.23)
lngdp		0.184*
		(1.66)
edu		-10.061
		(-1.11)
open		0.432**
		(2.38)
sci		3.328
		(1.40)
lnpop		-0.048
		(-0.65)
ind		-1.156***
		(-3.39)
env		0.263
		(0.29)
Constant	8.789***	8.288***
	(150.53)	(5.50)
N	310	310
R ²	0.619	0.669
Individual effects	yes	yes
The year effect	yes	yes
Note: **p<0.01, *p<0.05, *p<0.10, same as in the following tables.		

6.2. Analysis of Intermediary Effect

To address potential limitations in three-step mechanism analysis, this study adopts Jiang's two-step methodology. Existing research has explored how digital inclusive finance promotes entrepreneurship. Digital inclusive finance directly stimulates entrepreneurial activities through improved credit accessibility, reduced financial transaction costs, and enhanced payment settlement convenience. It also exerts indirect effects via market opportunity expansion, risk diversification, and ecosystem optimization (Zhang et al., 2021) [34]. Additionally, three dimensions explain its direct impact: 1) improved financing efficiency for startups; 2) strengthened entrepreneurial willingness and capabilities among residents; 3) targeted policy support (Jiang et al., 2023) [35]. The transmission mechanisms are further elaborated through three angles: facilitating knowledge spillover and learning, optimizing talent mobility and matching, and empowering entrepreneurial service platforms.

Table 3 presents the regression results of digital infrastructure development on the coverage breadth of digital inclusive finance. The data in the table reveal that the regression coefficient for column (2) shows a statistically significant positive correlation at the 5% level, indicating that enhanced digital infrastructure can improve urban entrepreneurial activity by expanding the reach of digital inclusive finance. Furthermore, the coverage breadth of digital inclusive finance demonstrates partial mediating effects. Hypothesis H2 is therefore validated.

Table 3. Analysis results of mediation effect

Variable	(1)	(2)
	Entre	Coverage
Dig	0.603***	0.142**
	(3.23)	(2.41)
Controlled Variable	yes	yes
N	310	310
R ²	0.669	0.998
Individual effects	yes	yes
The year effect	yes	yes

6.3. Analysis of Regulatory Effect

By incorporating an interaction term between digital infrastructure development and efficient market conditions into the benchmark model, the regression results (Table 4) reveal a negative coefficient for the interaction term that passes the 5% significance test. As marketization intensifies, the positive impact of digital infrastructure on entrepreneurial activity diminishes. In highly marketized markets where traditional mechanisms already function effectively, digital infrastructure may serve merely as a "complementary tool" rather than an "innovation engine," thereby reducing its marginal contribution to entrepreneurship. This finding validates Hypothesis H3.

Table 4. Analysis results of adjustment effect

Variable	(1)	(2)
	Entre	Entre
Dig	0.603***	0.906***
	(3.23)	(3.44)
Market		-0.000
		(-0.01)
Dig* Market		-0.049**
		(-2.06)
controlled variable	yes	yes
N	310	310
R ²	0.669	0.675
Individual effects	yes	yes
The year effect	yes	yes

6.4. Robustness Test

The above research results show that the construction of digital infrastructure has significantly improved regional entrepreneurial activity. In order to ensure the robustness and reliability of the research conclusions, this part carries out a series of robustness tests for verification.

6.4.1. Add Control Variables

To control for other infrastructure factors that may influence entrepreneurial activity and avoid estimation bias caused by omitted variables, traditional infrastructure was

added as an additional control variable in the benchmark regression model. The regression results in column (1) of Table 5 show that after controlling for railway mileage, neither the coefficient direction nor the significance level of digital infrastructure construction changed substantially, maintaining the robustness of the core conclusions.

6.4.2. Adjust the Sample Data

Given the significant disparities in economic development levels and policy resource endowments between Beijing, Shanghai, Tianjin, and Chongqing (the municipalities directly under the central government) and other provincial regions, entrepreneurial activity levels in these municipalities may exhibit heterogeneity, potentially distorting overall regression results. To address this, we excluded data from these four municipalities and re-estimated the model. As shown in Table 5(2), the removal of municipalities maintained the significant positive impact of digital infrastructure development on regional entrepreneurial activity, with no notable effect observed in the benchmark regression results.

6.4.3. Re-quantifying the explanatory Variables

To assess the robustness of core explanatory variables and mitigate potential biases in indicator selection, we replaced the measurement of digital infrastructure development. Following established research approaches, we substituted the original explanatory variable with mobile phone penetration rate—a key indicator reflecting regional information and communication infrastructure coverage and adoption levels, serving as a crucial measure of digital infrastructure. The regression results in Table 5(3) demonstrate that using mobile phone penetration rate as a proxy for digital infrastructure development maintains statistically significant positive effects on regional entrepreneurial activity.

The above robustness test results consistently show that the core research conclusion that digital infrastructure construction significantly improves regional entrepreneurial activity has good robustness.

Table 5. Results of robustness test

	(1)	(2)	(3)
	Add control variables	Some variables are excluded	Replacement of explanatory variables
Dig	0.536*** (2.74)	0.677*** (3.15)	0.376** (2.04)
Tra	-0.327 (-1.13)		
controlled variable	yes	yes	yes
N	310	270	300
R ²	0.670	0.687	0.669
Individual effects	yes	yes	yes
The year effect	yes	yes	yes

6.5. Heterogeneity Test

Due to China's vast land area and complex geographical environment, there are differences in economic development level and digital financial level among different regions. Therefore, according to the regional division of the National Bureau of Statistics, 31 provinces are divided into eastern, central and western regions to test the impact of digital infrastructure construction on regional entrepreneurial

activity. The specific results are shown in Table 6.

Table 6. Regression results of heterogeneity

	(1)	(2)	(3)
variable	east	central section	west
Dig	0.845*** (0.226)	1.028 (0.657)	0.0365 (0.311)
controlled variable	yes	yes	yes
N	110	80	120
R ²	0.782	0.797	0.761
Individual effects	yes	yes	yes
The year effect	yes	yes	yes

7. Conclusions and Policy Recommendations

Stimulating entrepreneurial vitality is the core driver for achieving more adequate and higher-quality employment, and a key support for enhancing urban economic momentum and improving people's livelihoods. This paper utilizes China's provincial panel data from 2013 to 2022 to systematically evaluate the impact of digital infrastructure construction on urban entrepreneurial activity. The study finds that digital infrastructure development significantly enhances regional entrepreneurial activity, a conclusion supported by a series of robustness tests. The coverage breadth of digital inclusive finance partially mediates the relationship between digital infrastructure and entrepreneurial activity, with digital infrastructure indirectly promoting entrepreneurship through expanded coverage. Regional marketization has a negative moderating effect on the entrepreneurial promotion effect of digital infrastructure, as increased marketization weakens the marginal contribution of digital infrastructure. The mechanism involves resource aggregation and functional substitution. Based on the aforementioned theoretical analysis and empirical research findings, this study proposes the following policy recommendations:

First, optimize the balanced distribution of digital infrastructure to strengthen foundational support for innovation and entrepreneurship. Promote comprehensive new digital infrastructure development across urban and rural areas, enhance 5G and cloud computing coverage density and service capabilities, and reduce data application costs for small and medium-sized enterprises (SMEs). Facilitate interconnectivity between government, industrial, and financial data by establishing standardized sharing platforms that provide precise data resource support. Develop a diversified investment model combining government guidance with market-driven mechanisms, improve performance evaluation systems, and prevent redundant construction. Enhance integration of digital infrastructure with entrepreneurial scenarios by developing and promoting intelligent tools and services tailored for SMEs.

Second, enhance the penetration mechanism of inclusive financial services to improve the efficiency of venture capital allocation. Deepen the synergy between digital infrastructure and financial services, leveraging technological innovation to optimize the supply of inclusive finance. Encourage the development of digital credit products and refine multi-dimensional credit evaluation systems to alleviate financing constraints for startups. Expand digital financial service coverage in rural and county areas while increasing the penetration rates of mobile payments and robo-advisors.

Establish a tiered and dynamic regulatory framework that balances coverage expansion with risk prevention, ensuring precise allocation of financial resources to empower entrepreneurship.

Third, coordinate market and government functions to curb the risk of widening the "digital divide". Implement differentiated governance based on regional marketization levels: developed regions should strengthen anti-monopoly measures to restrain platform data monopolies, while underdeveloped regions should provide targeted support through tax incentives. Establish a dynamic monitoring and allocation mechanism for digital resources to assess the impact of market concentration on entrepreneurial ecosystems. Align anti-monopoly policies with startup incubation measures to prevent disorderly capital expansion from squeezing small and medium-sized enterprises, thereby promoting the diffusion of digital dividends across diverse stakeholders.

Fourth, optimize institutional frameworks through localized adaptation to foster regional entrepreneurial ecosystems. Develop differentiated institutional mechanisms: Eastern regions should prioritize enhancing data element market environments by strengthening anti-monopoly measures and data openness, regulating platform monopolies through algorithm registration and data registration systems, while implementing digital startup exemption periods to stimulate high-tech ventures. Central and western regions should increase fiscal subsidies and tax incentives for digital infrastructure development, improve collaborative mechanisms for cloud computing centers, and reduce institutional costs through "investment credits + tax rebates". Establish cross-regional digital resource allocation platforms with coordinated policies to ensure the diffusion of development dividends.

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