

Original Research Article

Does the digital economy increased entrepreneurial activity? – empirical evidence from Chinese cities

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Abstract: The digital economy is a crucial strategic resource for high-quality development at the national and regional levels, and its development has significantly boosted regional entrepreneurial vitality. This paper uses panel data from 282 prefecture-level cities in China from 2011 to 2021 to examine the impact and mechanism of the digital economy on entrepreneurial activity. The study finds that the development of the digital economy significantly increases urban entrepreneurial activity, with alleviating financing constraints and optimizing the business environment being important transmission pathways for this impact.

Keywords: digital economy; entrepreneurial activity; financing constraints; business environment

1. Introduction

Entrepreneurial activity, as a process of identifying, valuing, and seizing economic opportunities, can transform resources into higher forms of value by combining factors of production (Jafari-Sadeghi et al.). 2021 ; Zahra, (2021) . Entrepreneurial activity (ENTAY) is the most direct indicator of a region's entrepreneurial level and innovation capacity . It can effectively attract high-quality factors such as capital, human resources, and technology, and is a direct lever for increasing social wealth and promoting high-quality economic development (Boudreaux et al., 2021). 2022 ; Silva et al., (2022) . With the continuous integration of digital technologies such as mobile internet, big data, artificial intelligence, and blockchain with the traditional economy, the scale of China's digital economy and its proportion in the national economy have both increased rapidly (SY Luo et al., 2022). (2023) . The digital economy, leveraging its high penetration, speed, and externalities, deeply integrates with all domains of the economy and society, continuously generating new industrial development opportunities and providing abundant information and technological support for entrepreneurship (Sahut et al., 2023). (2021) . Therefore, leveraging the role of the digital economy in enhancing urban entrepreneurial activity has significant theoretical and practical implications for achieving common prosperity.

Therefore, this paper's potential marginal contributions lie in three aspects: First, drawing on existing literature, this paper provides a relatively comprehensive measurement of the digital economy and entrepreneurial activity at the city level, discussing in depth how the digital economy influences urban entrepreneurial activity within a unified framework . Second, this paper comprehensively assesses the role of the digital economy in improving urban entrepreneurial activity, finding that the digital economy primarily enhances urban entrepreneurial activity through two paths : alleviating financing constraints and improving the business environment , thus broadening the scope of existing research. Third, this paper conducts empirical testing using data from 282 prefecture-level cities across China from 2011 to 2021. Compared to traditional provincial-level data studies, this approach more accurately measures regional differences in the relationship between the digital economy and urban entrepreneurial activity, and through a series of robustness endogeneity tests, the research results are more credible .

2. Theoretical mechanisms and research hypotheses

2.1. The development of the digital economy has increased the entrepreneurial activity in cities

First, from the perspective of the startup market , on the one hand, the digital economy, as a new economic model, has broadened the industrial base and brought new business opportunities and market space to the

startup market (Climent & Haftor). (2021) . For example, Lamine et al. (2023) pointed out that enterprises use digital technology to create a more optimized infrastructure. The improved network infrastructure provides a convenient information platform for entrepreneurial activities, promotes the grasp of business opportunities and communication in the entrepreneurial process, and thus provides new momentum and new thinking for entrepreneurship. Therefore, research hypothesis 1 is proposed:

H1: The development of the digital economy has increased the entrepreneurial activity in cities.

(ii) The development of the digital economy can enhance urban entrepreneurial activity by alleviating financing constraints.

A company's ability to raise sufficient funds for the combination of production factors is fundamental to its stable development. Cultivating an innovation-driven entrepreneurial spirit requires broad credit support (Charfeddine & Zaouali). (2022) .Therefore, research hypothesis 2 is proposed:

Hypothesis H2: The development of the digital economy increases urban entrepreneurial activity by alleviating financing constraints.

2.2. The development of the digital economy enhances urban entrepreneurial activity by optimizing the business environment

A favorable business environment is conducive to increasing entrepreneurial activity. Firstly, a favorable government environment helps promote equitable access to factors of production for different market entities (Wu & Lin). (2022) . Therefore, research hypothesis 3 is proposed:

Hypothesis H3: The development of the digital economy increases urban entrepreneurial activity by optimizing the business environment.

3. Indicator construction, data sources and identification strategies

3.1. Indicator construction

3.1.1. Dependent variable selection

Entrepreneurial activity (ENTAY) : Entrepreneurial activity is an important indicator for measuring the level of entrepreneurial activity in a region. This paper draws on existing research (Luo et al., (2022) , measured by the number of newly registered enterprises per 10,000 people in a city , denoted as ENTAY . The statistics were compiled by manually searching the Tianyancha website for the number of newly registered enterprises in each city each year .

3.1.2. Selection of independent variables

Considering the availability of city-level data, the following metrics are selected to represent the level of internet development at the city level: internet penetration rate (number of broadband internet users per 100 people), related employment (proportion of computer service and software employees in urban units), related output (total telecommunications business volume per capita), and mobile phone penetration rate (number of mobile phone users per 100 people). The China Digital Inclusive Finance Index calculated by Peking University is selected to characterize the level of digital finance development in cities . The comprehensive digital economy development index, denoted as dige , is calculated using the principal component method .

3.1.3. Mechanism variables

Financing Constraints (FINT) : Digital inclusive finance can provide convenient , efficient , and low-threshold financing for startups , thereby effectively alleviating the problems of difficult and expensive financing for startups . This paper draws on existing research and selects the credit index from the Peking University Digital Inclusive Finance Index as a proxy variable for testing the mechanism to alleviate financing constraints .

Business Environment (BUET) : Existing research mostly measures the business environment based on provincial-level marketization indices and the construction of multi-dimensional indicator systems, but there is a lack of scientific measurement at the city level. Considering data availability, this paper draws on existing research (Yu et al., (2023) This evaluation uses urban business environment data released by the China Business Environment Evaluation Group .

3.2. Identification strategy

To examine the effect of DIGE on ENTAY , this paper constructs the following benchmark model:

$$ENTAY_{it} = \alpha_0 + \alpha_1 DIGE_{it} + \alpha_2 Z_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

Here, ENTAY it represents the entrepreneurial activity level of city i in period t , and DIGE it represents the digital economy development level of city i in period t . To address the endogeneity issues caused by omitted variables, control variables (Z_{it}) are introduced .In equation (1), the last three terms are the individual fixed effect, the time fixed effect, and the random error term, respectively.

$$MV_{it} = \beta_0 + \beta_1 DIGE_{it} + \beta_2 Z_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2)$$

$$ENTAY_{it} = \alpha_0 + \alpha_1 DIGE_{it} + \alpha_2 MV_{it} + \alpha_3 Z_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3)$$

To enhance the robustness of mechanism testing, we draw on the approach of existing literature (Zhou et al., 2022 ; Zhou & Li (2023)), using interaction terms for testing. The specific model settings are as follows:

$$ENTAY_{it} = \alpha_0 + \alpha_1 DIGE_{it} + \alpha_2 DIGE_{it} \cdot MV_{it} + \alpha_3 Z_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (4)$$

3.3. Data source

This paper uses 282 prefecture-level cities in China from 2011 to 2021 as the research sample. The relevant data comes from the *China Urban Statistical Yearbook*, EPS , and Wind databases.

4. Empirical analysis

4.1. Benchmark regression

Table 2 reports the regression results of the digital economy development level on urban entrepreneurial activity . The results of the baseline regression are basically in line with expectations. Columns (1) and (2) discuss the specific impact of DIGE on ENTAY based on the OLS model . The results show that the coefficient of the independent variable (DIGE) is significantly positive . Columns (3) and (4) are the regression results based on the fixed effects model. The results still show that there is a significant positive relationship between DIGGE and ENI . Therefore , Hypothesis 1 is verified. The digital economy can effectively improve urban entrepreneurial activity. For every 1% increase in the digital economy , the urban entrepreneurial activity increases by an average of 0.08 % . This conclusion is basically consistent with existing literature (Liu et al., 2022 ; Sun & You 2023 ; Yin et al., 2019) .

Table 1. Benchmark regression.

	(1)	(2)	(3)	(4)
	OLS		Fixed effects	
DIGE	0.792*** (0.020)	0.505*** (0.020)	0.126** (0.058)	0.080** (0.033)
pgdp		0.227*** (0.018)		0.012 (0.011)
pnd		0.004* (0.002)		0.024*** (0.004)
fdi		0.146*** (0.007)		1.853*** (0.385)
fin		-0.021*** (0.003)		-0.006** (0.003)
urban		0.894*** (0.039)		-0.240* (0.134)
trans		0.000 (0.001)		0.029*** (0.004)
_cons	-1.045*** (0.139)	-1.391*** (0.145)	3.555*** (0.397)	3.618 *** (0.255)
City FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N	3102	3102	3102	3102
adj. R ²	0.413	0.618	0.908	0.912

Note: (1) The standard error in parentheses is robust; (2) ***, **, and * represent significance levels of 1%, 5%, and 10%, respectively, and the same applies below.

5. Further discussion

5.1. Mechanism testing

Table 2 reports the results of the mechanism test. On the one hand, the classic three-step method of mediating variables was used; on the other hand, the robustness of the mechanism test was enhanced through interaction terms. As can be seen from Table 2, DIGE improves ENTAY by alleviating financing constraints and optimizing the business environment.

Table 2. Mechanism analysis.

	(1)	(2)	(3)	(4)	(5)	(6)
	FINT	ENTAY	BUET	ENTAY	ENTAY	ENTAY
DIGE	0.362 *** (0.052)	0.105 *** (0.033)	0.015 *** (0.002)	0.081 ** (0.033)	0.149 *** (0.036)	0.093 *** (0.032)
FIND		-0.063 *** (0.012)				
PAIN				2.185 *** (0.271)		
D_FINT					-0.011 *** (0.002)	
D_BUET						0.349 *** (0.031)
pgdp	0.020 (0.018)	0.013 (0.011)	-0.000 (0.000)	0.012 *** (0.003)	0.013 (0.011)	0.011 (0.011)
pnd	-0.016 *** (0.006)	0.023 *** (0.004)	0.071 *** (0.000)	0.132 *** (0.007)	0.023 *** (0.004)	-0.147 *** (0.016)
fdi	1.182* (0.605)	1.926 *** (0.385)	-0.004 (0.004)	1.861 *** (0.385)	1.917 *** (0.385)	1.969 *** (0.377)
exquisite	0.000 (0.005)	-0.006 ** (0.003)	0.000 (0.000)	-0.006 ** (0.003)	-0.006 ** (0.003)	-0.003 (0.003)
urban	1.474 *** (0.213)	-0.143 (0.136)	-0.006 *** (0.001)	-0.228 * (0.135)	-0.152 (0.136)	0.092 (0.135)
across	-0.001 (0.007)	0.029 *** (0.004)	0.000 (0.000)	0.029 *** (0.004)	0.029 *** (0.004)	0.029 *** (0.004)
_cons	1.515 *** (0.405)	3.697 *** (0.258)	0.005* (0.003)	3.607 *** (0.255)	3.446 *** (0.259)	3.373 *** (0.250)
City FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	3094	3094	3102	3102	3094	3102
adj. R ²	0.644	0.913	1.000	0.912	0.912	0.916

6. Conclusions

Based on urban panel data from China from 2011 to 2021, it employs fixed-effects models, mediation-effects models to examine the promoting effect of the digital economy on entrepreneurial activity and its underlying mechanisms from multiple perspectives. The main conclusions are as follows: First, the development of the digital economy can significantly promote entrepreneurial activity. The digital economy's contribution to regional entrepreneurial activity has significant practical value for expanding the domestic consumer market and building a domestic economic cycle. Through mechanism analysis, the results show that the digital economy

influences entrepreneurial activity through two channels: improving the business environment and alleviating financing constraints .

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