



# The Impact of Information Consumption on Urban Entrepreneurial Activity - A Quasi-natural Experiment from the Pilot Policy of National Information Consumption City

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**Abstract.** China's information consumption has become one of the consumption fields with rapid growth, active innovation and entrepreneurship, and wide coverage. Based on the panel data of 268 prefecture-level cities in China from 2010 to 2021, this paper constructs a multi-period difference-in-difference model to explore the impact of information consumption pilot policies on urban entrepreneurial activity. The results show that the pilot policy of information consumption has significantly improved the entrepreneurial activity of the city; the mechanism analysis finds that the policy pilot promotes the improvement of entrepreneurial activity by expanding the level of urban consumer demand on the demand side. Heterogeneity analysis shows that the promotion effect of information consumption pilot policy on entrepreneurial activity in eastern cities is significantly stronger than that in central and western cities. In view of this, all localities should improve the policy design of pilot policies on improving urban entrepreneurship activity; give full play to the effect of policies to promote the level of urban consumer demand, and ensure the smooth flow of the policy transmission mechanism; we will implement pilot policies in a targeted, flexible and tailored manner, maximize the entrepreneurial effect of information consumption, and cultivate a new soil for entrepreneurship.

**Keywords:** National information consumption pilot, City entrepreneurship activity, Multiphase difference-in-difference design, Level of demand in consumption

## 1 Introduction

Entrepreneurial activity is a crucial metric for assessing a nation's or region's level of economic activity. It is not only linked to the health of the urban economy but also serves as a barometer for a city's capacity for innovation and future growth. The report of the 20th National Congress of the Communist Party of China highlights the need to accelerate the development of the digital economy and promote the deep integration of

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the digital economy and the real economy in order to build a modern socialist country in an all-around manner and to promote the high-quality development of our country. Consumption of information, a crucial component of the digital economy, can effectively encourage the growth of the socialist market economy and the rise of domestic demand.

The new consumption mode of information is exemplified by smartphones, virtual and augmented reality, live e-commerce, ultra-high definition video, and online health and education services. China's market for information consumption has grown in size over the past few years. It is crucial to the comprehensive execution of the policies aimed at boosting domestic demand, strengthening supply-side structural reform, boosting domestic circulation's inherent power, and advancing the socialist market economy. It also gives the thriving digital economy a boost<sup>[1]</sup>. The "Opinions on Promoting Information Consumption and Expanding Domestic Demand," released by the State Council in 2013, outlined the principal goals, essential duties, and general prerequisites for advancing the growth of information consumption. The Ministry of Industry and Information Technology then published a list of 104 information consumption pilot cities in two batches in 2013 and 2014 in an effort to support policy, boost the availability and scale of information consumption, and encourage the growth of the digital economy. In light of this policy, this study builds a multi-period difference-in-difference model, selects panel data from 268 prefecture-level cities from 2010 to 2021, and examines the impact of the information consumption pilot program on urban entrepreneurial activity.

## 2 Literature Review and Theoretical Analysis

China's level of internet consumption has grown extremely quickly in the last several years. In this regard, digital consumption has greatly boosted and empowered people from all walks of life. Theoretically, the information consumption pilot program may operate as a catalyst for China's economy's high-quality development and have a direct or indirect effect on promoting industrial transformation and upgrading. According to Han Lv et al. (2023)<sup>[2]</sup>, the information consumption city pilot program encouraged the city's high-quality economic development through the employment, industrial, and innovation effects. The fundamental prerequisites, including infrastructure, the degree of marketization, and the capacity for technical innovation, are favorable to enhancing the contribution of information consumption to the advancement of superior economic development. He Lingyun et al. (2022)<sup>[3]</sup> thought that information consumption, a new kind of consumption created by the deep integration of information technology and traditional consumption, had grown significantly in the previous few years and was a major factor in China's economy's sustainable recovery as well as the modernization and transformation of the industrial structure in the post-epidemic era. Digital consumption has significantly boosted China's economic growth, according to Ru Huichao et al. (2023)<sup>[4]</sup>. This finding holds up to robustness tests that take into account endogenous problems, policy time lag effect, exclusion of heterogeneity processing effect, control over urban characteristics, and national big data comprehensive pilot area policy.

According to Yan et al. (2024)<sup>[5]</sup>, policy pilots support urban innovation on the supply side of the information industry through three mechanisms: the allocation of production factors, the industrial agglomeration effect, and the industrial optimization effect. By improving the structure of information consumption and reducing backward and emerging information consumption, the policy pilot, on the demand side of the information industry, fosters urban innovation.

Studies on the effect of information consumption on entrepreneurship are currently few. This paper aims to examine the effects of information consumption pilot policy on urban entrepreneurial activity from a national policy perspective, as the majority of research on the development effect of digital consumption focuses on driving industrial upgrading and promoting economic growth.

The market now has access to an affordable platform for exchanging information thanks to the growth of information consumption. Entrepreneurs can reduce their costs associated with information gathering and collection by utilizing big data Internet and other technologies. There is a platform for information exchange that acts as a bridge for both the information transmission during and before entrepreneurship. The growth of information consumption also gives locals access to a plethora of fresh concepts and cutting-edge tools for starting their own businesses, which greatly stimulates such endeavors and establishes a strong basis. Thus, the first hypothesis is proposed: the information consumption pilot program has greatly enhanced urban entrepreneurship.

By updating information infrastructure, boosting residents' diverse product demands, encouraging the expansion of market demand, and raising the supply innovation level of consumer electronics products, information consumption increases job prospects. Thus, Hypothesis 2 is proposed: by raising the amount of urban consumer demand, the information consumption pilot policy has encouraged urban entrepreneurship.

The evolution of information consumption is contingent upon the state of development and economic standing of cities across different regions. Compared to the center and western parts of the country, eastern Chinese cities are more advanced. There are also differences in the amount of information consumed by locals and the quality of support provided by local governments. There will be differences in the effects of information consumption pilot programs on cities in the eastern, central, and western regions, as well as in the extent to which entrepreneurial activity is encouraged. Thus, hypothesis 3 is proposed: the eastern region has a greater promotion effect of the information consumption pilot program on urban entrepreneurial activity than do the central and western regions.

### **3 Research Design**

#### **3.1 Variable Selection and Data Sources**

##### ***3.1.1 Variable Being Explained***

The explained variable of this paper is the entrepreneurial activity (EA) of the city. Based on the practice of relevant scholars, the number of new ventures per 100 people in the city is measured<sup>[6]</sup>.

### 3.1.2 Core Explanatory Variables

The information consumption pilot policy (did) serves as the primary explanatory variable in this study. This study uses the year following the pilot cities as the start time of the policy, which is set to 1, and the remaining part of the year is set to 0, taking into account that the policy announcement time of each round of pilot cities is the end of the year. The official records of China's Ministry of Industry and Information Technology are the source of the list of pilot cities. The cities that have pilot policies as county or district administrative divisions are kept, but the cities with significant data gaps are removed. Ultimately, the study's experimental group consists of 82 pilot cities for information consumption, while the control group consists of the remaining cities.

### 3.1.3 Control Variable

This paper selects a series of factors that may affect the activity of urban entrepreneurship as control variables, specifically : ( 1 ) the level of economic development ( EL ), measured by the city 's per capita GDP, and logarithmically processed ; ( 2 ) The degree of marketization ( MD ), measured by the ratio of the city 's GDP to the government 's general public budget expenditure ; ( 3 ) the degree of opening to the outside world ( FDI ), measured by the ratio of foreign direct investment to GDP ; ( 4 ) Human capital level ( HC ), measured by the number of undergraduate and junior college students per 100 people ; ( 5 ) Financial development level ( FL ), which is measured by the ratio of the sum of deposits and loans of financial institutions to GDP ; ( 6 ) Infrastructure level ( RP ), which is measured by the per capita road area of the city and logarithmically processed ; ( 7 ) Salary level ( SA ), which is measured by the average salary of employees on the job, and logarithmically processed ; ( 8 ) Industrial structure ( IS ), measured by the ratio of the added value of the tertiary industry and the secondary industry.

The panel data of Chinese cities and municipalities at the prefecture level from 2010 to 2021 is chosen for this article. These include the enterprise survey database for data on urban new ventures, the China Urban and Rural Construction Statistical Yearbook for data on urban road areas, and the China Urban Statistical Yearbook for data on remaining urban ventures. The interpolation method is used to fill in the missing values in the data. Descriptive statistics between variables are shown in **Table 1**, and a Pearson correlation analysis between variables is shown in **Table 2**.

**Table 1.** Descriptive statistics between variables

VARIABLES	N	mean	sd	min	max
EA	3,216	1.269	1.233	0.160	20.24
EL	3,216	10.71	0.593	8.576	13.06
MD	3,216	6.034	2.465	0.667	17.14
FDI	3,216	1.620	1.795	0	21.17
HC	3,216	1.890	2.432	0	13.98
FL	3,216	2.473	1.224	0.607	21.20
RP	3,216	10.46	0.787	7.234	13.46

SA	3,216	10.90	0.388	8.509	12.21
IS	3,216	1.042	0.596	0.109	5.348

**Table 2.** Pearson correlation analysis between variables

Variables	EA	EL	MD	FDI	HC	FL	RP	SA	IS
EA	1.000								
EL	0.553	1.000							
MD	0.217	0.568	1.000						
FDI	0.096	0.219	0.175	1.000					
HC	0.369	0.476	0.272	0.256	1.000				
FL	0.342	0.223	-0.154	0.046	0.576	1.000			
RP	0.451	0.748	0.365	0.226	0.504	0.346	1.000		
SA	0.484	0.628	-0.022	-0.022	0.300	0.439	0.482	1.000	
IS	0.260	0.070	-0.297	-0.026	0.321	0.585	0.145	0.417	1.000

### 3.2 Model Design

The information consumption pilot policy is utilized as a quasi-natural experiment, drawing on the work of pertinent scholars, and the multi-period difference-in-differences method is employed to assess the effect of information consumption on urban entrepreneurial activity. The following are the particular research models:

$$EA_{it} = \beta_0 + \beta_1 DID_{it} + \sum \beta_j Z_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Among them, EA represents the entrepreneurial activity of the city, DID is the dummy variable of the information consumption pilot policy, Z is a set of control variables to control the impact of other factors on the entrepreneurial activity of the city,  $\mu$  is the city fixed effect,  $\lambda$  is the time fixed effect,  $\varepsilon$  is the random disturbance term, i and t represent the city and year respectively, and  $\beta$  is a series of estimation coefficients.

In addition, in order to evaluate the long-term impact of the information consumption pilot policy on urban entrepreneurial activity, this paper refers to the event research method<sup>[7]</sup>, and uses the first period in advance as the benchmark group for estimation, and sets the following model:

$$EA_{it} = \beta_0 + \sum_{\varphi \geq -4}^6 \beta_k D_{it}^{\varphi} + \sum \beta_j Z_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

Among them, D is a series of dummy variables, indicating whether to build a national information consumption city; the trademark  $\varphi$  is the difference between each year t and the pilot year. If the pilot year of city i is  $\omega$ , then  $\varphi = t - \omega$ . When  $\varphi = -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6$ , the corresponding D is recorded as 1, otherwise 0. By observing the statistical and economic significance of the coefficient  $\beta$ , we test whether the pilot policy of information consumption has a long-term effect.

## 4 Empirical results and Robustness Test

### 4.1 Baseline Regression Results

**Table 3** displays the benchmark regression findings. The regression result without control variables is shown in Column (1), while the regression result with control variables is shown in Column (2). At the statistical significance thresholds of 1% and 5%, respectively, the coefficients of the variable DID are significantly positive, suggesting that the information consumption pilot program has greatly boosted the pilot cities' entrepreneurial activity.

**Table 3.** Baseline regression results

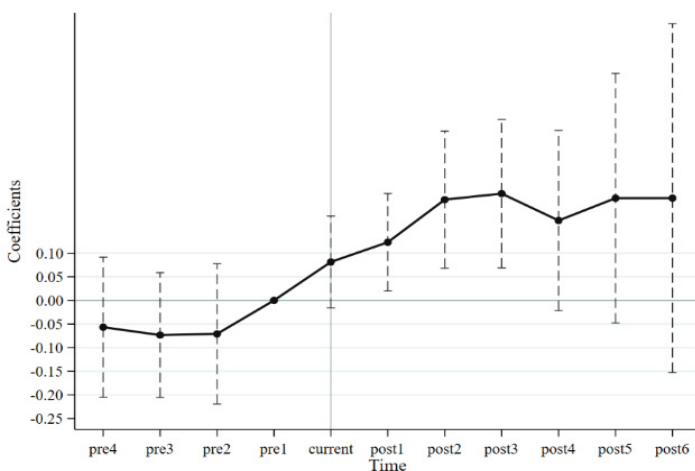
VARIABLES	(1) EA	(2) EA
DID	0.269*** (2.980)	0.226** (2.432)
EL		0.052 (0.267)
MD		-0.022 (-0.697)
FDI		-0.008 (-0.476)
HC		0.118* (1.968)
FL		-0.095* (-1.815)
RP		-0.293*** (-3.212)
SA		-0.121 (-0.977)
IS		-0.076 (-0.573)
Constant	1.216*** (68.538)	5.287** (2.152)
Observations	3,216	3,216
R-squared	0.704	0.710
City FE	YES	YES
Year FE	YES	YES

Note: The T value in brackets is calculated by robust standard error with cities as clustering.

## 4.2 Parallel Trends and Dynamic Effects

The premise of the difference-in-difference model is to match the parallel trend, i.e., the trend of urban entrepreneurial activity in pilot cities and non-pilot cities should be consistent prior to the information consumption pilot policy's implementation. In this paper, we test using Model (2). Figure 1 illustrates that prior to the implementation of the pilot strategy, the dummy variable D's coefficient is not statistically significant, and its absolute value is less than 0.1. Before the pilot policy, the development trend of entrepreneurial activity in pilot cities and non-pilot cities is essentially consistent, which means it satisfies the parallel trend hypothesis. After the pilot policy, the coefficient of the dummy variable D is more than 0.2 in the majority of years.

The information consumption pilot policy's dynamic influence is further demonstrated by the results of the parallel trend test. **Fig. 1** illustrates how the pilot program encouraged urban entrepreneurship in the first year following implementation and how the policy's impact peaked in the third year following the program.



**Fig. 1.** Parallel trend test

## 4.3 Placebo Test

This research employs the anti-real-time verification approach to do the placebo test in order to further verify that the improvement of urban entrepreneurial activity in pilot cities is related to the information consumption pilot strategy. In order to create a new treatment group with a random city and policy time, the same number of samples as the previous treatment group were randomly picked from all samples, drawing on the work of pertinent scholars. This is used to re-estimate the benchmark regression model and randomly rerun 500 experiments. **Fig. 2** displays the kernel density distribution.

The regression results are shown in Fig. 2 to be regularly distributed and concentrated at 0. The estimated coefficient of DID in the baseline regression is represented

by the dashed line. The placebo test is successful since there is less than 5% chance that the estimated coefficient of 500 placebos will exceed the baseline regression coefficient. This suggests that the baseline regression results were not produced by chance<sup>[8]</sup>. That is, it is unlikely that chance or other exogenous shocks will affect this paper's conclusion.

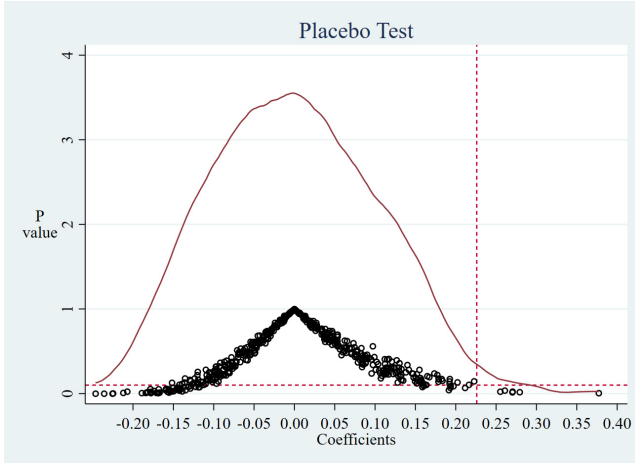


Fig. 2. Kernel density distribution

#### 4.4 Goodman-Bacon Decomposition and Heterogeneity Estimation

When using the progressive difference-in-difference method to evaluate the policy effect, the average treatment effect is the weighted result of the treatment effect of different groups in each period. The heterogeneity of each group in the time dimension may lead to the estimation result of the multi-period DID model is not robust<sup>[9][10]</sup>. Referring to Goodman-Bacon's method, this paper uses the Bacon decomposition method to decompose the processing effect size and weight estimated by the traditional two-way fixed effect (TWFE)<sup>[10]</sup>. **Table 4** reports the results of Bacon decomposition. From the table, it can be seen that the estimator of TWFE mainly comes from the grouping of ' processing group VS never processing group ', which accounts for 95.8 % of the TWFE estimator, while the grouping of ' post-processing group VS pre-processing group ', which may lead to the bias of TWFE estimator, only accounts for 1.8 %, and the weight in the estimator is very small, so it will not lead to significant deviation of the estimator<sup>[11]</sup>.

Table 4. Bacon decomposition table

Different types of grouping	Weighted Average	Weight
Group Treatment VS Never Group Treated	0.282	0.951
Earlier Group Treatment VS Later Group Control	0.025	0.030
Later Group Treatment VS Earlier Group Control	-2.336	0.018



#### 4.5 Other Robustness Tests

1. Considering that macro-environmental changes such as policy changes at the provincial level have an impact on urban entrepreneurship activity, the interaction between provinces and years is further introduced to capture systemic macro-changes.

2. Replace the explained variable. Drawing on the practice of other scholars, the number of urban private and individual employees and the number of employees at the end of the year are used to represent the level of regional entrepreneurship<sup>[12]</sup>.

3. Tail reduction processing, all variables are reduced by 1 % up and down to reduce the interference of extreme values of variables on the regression results.

4. Excluding municipalities directly under the central government, municipalities may lead to biased regression results due to higher political status and policy implementation conditions<sup>[13]</sup>. Other robustness test results are shown in **Table 5**.

**Table 5.** Robustness test results

VARIABLES	(1)	(2)	(3)	(4)
	EA	PE	EA	EA
DID	0.184** (2.305)	22.767** (2.398)	0.208*** (2.895)	0.231** (2.388)
EL	-0.211 (-0.839)	14.707 (1.047)	-0.103 (-0.695)	0.063 (0.321)
MD	-0.011 (-0.344)	-1.193 (-0.500)	-0.015 (-0.702)	-0.020 (-0.633)
FDI	0.001 (0.076)	-1.768 (-0.882)	-0.009 (-0.543)	-0.007 (-0.453)
HC	0.158*** (3.246)	3.335 (0.594)	0.096** (1.994)	0.116* (1.919)
FL	-0.003 (-0.183)	-1.730 (-0.808)	-0.096** (-2.046)	-0.096* (-1.813)
RP	-0.202** (-2.165)	-33.675** (-2.334)	-0.221*** (-3.103)	-0.298*** (-3.242)
SA	-0.083 (-0.635)	-8.676 (-0.673)	-0.054 (-0.409)	-0.119 (-0.955)
IS	0.072 (0.834)	-17.808 (-1.361)	-0.206*** (-3.089)	-0.064 (-0.469)
Constant	6.203** (1.995)	381.089 (1.159)	5.581*** (2.879)	5.165** (2.092)
Observations	3,156	3,216	3,216	3,168
R-squared	0.807	0.791	0.775	0.709
City FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

## 5 Further Inspection and Analysis

### 5.1 Mechanism Analysis

Residents' consumption has been greatly impacted by the information consumption pilot policy's execution, which has raised urban consumer demand and encouraged the growth of urban entrepreneurship. In order to investigate the mechanism of information consumption pilot policy on urban entrepreneurship activity, this article employs the total retail sales of social consumer goods per capita as the proxy variable of consumption demand level<sup>[14]</sup>. The **Table 6**'s Column (1) displays the regression findings. According to the regression analysis, the information consumption pilot program greatly raises the amount of urban consumer demand, which in turn boosts local entrepreneurial activity.

### 5.2 Heterogeneity Analysis

For the purpose of heterogeneity study, the cities are categorized into three areas based on the provinces to which they belong: the eastern, central, and western regions. This classification approach was developed by Wang Yuan and Yang Guangliang (2016)<sup>[15]</sup>. The regression results of the national consumption pilot programs in the eastern, central, and western regions on urban entrepreneurial activity are shown in **Table 6**'s columns (2) and (3). Based on the findings, it can be said that the pilot program significantly contributes to the growth of eastern region cities' entrepreneurial scenes. Nonetheless, there is no statistical significance or significance in the estimated results of the policy regarding the entrepreneurial activity of cities in the central and western areas. The following are some potential causes: (1) regional development imbalance: information products are more popular in the eastern region than in the central and western regions, and local governments in the eastern region are better able to support the advancement of information consumption technology than their counterparts in the central and western regions.

**Table 6.** Further test and analysis

VARIABLES	(1) CP	(2) east city EA	(3) middle & west city EA
DID	0.218*** (3.969)	0.362** (2.180)	0.068 (1.138)
EL	1.450*** (7.329)	0.609* (1.684)	0.091 (0.550)
MD	-0.016 (-0.823)	0.051 (0.941)	0.007 (0.191)
FDI	-0.018 (-1.585)	0.018 (0.697)	0.024* (1.789)
HC	0.049*	0.260*	0.129***

	(1.847)	(1.741)	(2.826)
FL	-0.023	-0.136	0.029
	(-0.887)	(-1.425)	(0.629)
RP	0.018	-0.393*	-0.110
	(0.270)	(-1.936)	(-1.339)
SA	-0.332***	-0.573	-0.064
	(-2.680)	(-1.236)	(-0.834)
IS	0.112	-0.040	0.007
	(1.649)	(-0.172)	(0.092)
Constant	-10.403***	4.827	1.500
	(-4.201)	(0.755)	(0.894)
Observations	3,216	1,368	1,848
R-squared	0.908	0.734	0.632
City FE	YES	YES	YES
Year FE	YES	YES	YES

Robust t-statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 6 Conclusions and Policy Recommendations

The present study used the multi-period DID research technique to empirically investigate the mechanism of information consumption pilot policy on urban entrepreneurial activity, based on panel data of 3216 samples from 268 prefecture-level cities in China between 2010 and 2021. The following are the primary conclusions: (1) Policy related to information consumption greatly encourages urban entrepreneurship. Second, the information consumption pilot program greatly encourages residents to consume more, which in turn raises demand for consumption and fosters an improvement in entrepreneurial activity. Thirdly, while the effect of the strategy on cities in the central and western areas is less clear, it has a major role in fostering the entrepreneurial activity of cities in the eastern region.

The following are the policy implications derived from the aforementioned conclusions:

First, enhance the information consumption policy in order to boost urban entrepreneurship and fully utilize the policy's impact. Prioritize the creation of new business opportunities for residents by integrating and developing a new generation of information technology with a variety of sectors, and by giving them access to new channels and platforms. We can reduce the strain on residents' entrepreneurship, encourage their endogenous drive, and improve the entrepreneurial climate by providing tax breaks and governmental support.

Second, fully realize the potential of information consumption policies to raise consumer demand, facilitate the efficient implementation of policies, and, most importantly, boost urban entrepreneurship. Urban entrepreneurship can be enhanced and the level of urban consumption demand raised through the development and iteration of information products, which also serve to highlight the role of information

consumption policies on the demand side and the role of information products in helping people and facilitating industrial production.

Third, reduce the disparities in urban entrepreneurship levels between the eastern, central, and western regions, and enhance the applicability of information consumption policies for cities in various regions. Policies should be implemented flexibly to account for local realities. The information consumption pilot policy is naturally integrated with the city's development status and level to increase the pilot policy's adaptability and flexibility. Appropriate localization can be done without going against the policy's original intent. We can effectively encourage the growth of urban entrepreneurship, close the gap between entrepreneurship in different locations, and create new ground for entrepreneurship with the aid of the information consumption pilot policy.

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