Proceedings of ICFTBA 2026 Symposium: Digital Government, Finance, Accountability, and Sustainable Economic Development
DOI: 10.54254/2754-1169/2026.AB39009

Can National Independent Innovation Demonstration Zones Correct Venture Capital's Stage Bias?—Evidence from the Timing of Firms' First VC Investments

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Abstract. Venture capital (VC) is an important source of financing for the growth of technology-oriented firms. However, the substantial uncertainty surrounding early-stage firms may lead institutional investors to delay their initial investments until later stages of firm development. This paper exploits the staggered approvals of National Independent Innovation Demonstration Zones (NIDZs) as a quasi-natural experiment. Using data on firms' first institutional VC investments from 2005Q1 to 2023Q4, we construct a staggered difference-in-differences (DID) model to examine whether innovation policy shifts VC entry toward earlier stages. Based on 39,962 firm-level observations across 273 cities, we measure VC stage preferences using firm age at first VC investment (Age) and the probability of receiving VC within three years of establishment (Early3). We find that, following demonstration zone approval, firms receive their first VC investment 0.26 years earlier on average, and the probability of receiving VC within three years of establishment increases by 3.03 percentage points. Mechanism analysis provides relatively consistent support for the government risk-sharing channel. These findings indicate that innovation policy may affect not only the scale of capital allocation but also the timing of capital entry over the firm life cycle.

Keywords: National Independent Innovation Demonstration Zones, venture capital, stage preferences, first investment, staggered DID

1. Introduction

Venture capital (VC) plays an important role in supporting the growth of innovative firms. However, early-stage firms face information opacity, high technological risk, and other challenges, prompting investors to enter after firms have reached a more mature stage of development and resulting in a preference for later-stage investments. In recent years, the policy priority of "investing early, investing in small firms, and investing in hard technologies" has grown within China's innovation finance agenda. Nevertheless, direct evidence remains limited as to whether innovation policies can alter the timing of VC entry.

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By improving the technology finance system, strengthening fiscal support, and promoting the commercialization of research outcomes, National Independent Innovation Demonstration Zones may ease financing constraints faced by early-stage firms and shift VC entry toward earlier stages. However, these zones may also attract mature firms and high-quality projects, further concentrating capital at more mature stages. The effect of the policy on VC stage preferences therefore remains an empirical question.

This paper examines the timing of firms' first institutional VC investments. Exploiting policy variation arising from the staggered approvals of demonstration zones, we construct a staggered DID model and combine mechanism tests with heterogeneity analysis to examine whether innovation policy encourages VC investment at earlier stages of the firm life cycle.

2. Literature review and theoretical analysis

Previous studies suggest that innovation-driven policies can promote the geographic concentration of innovation resources and influence VC allocation. Related research finds that innovation policies strengthen firms' innovation capacity and entrepreneurship, while also encouraging the agglomeration of innovation inputs, including venture capital [1, 2]. The establishment of National Independent Innovation Demonstration Zones may influence VC flows by improving innovation platforms, optimizing the technology finance system, and reducing investment risks [3].

However, early-stage firms typically face information opacity and relatively high technological risks. Venture capital therefore tends to enter after firms have undergone market validation, exhibiting a preference for investment at later stages [4]. Research on venture capital indicates that the firm life cycle and investment risk affect the timing of capital entry. In this vein, a firm's age at first institutional VC investment serves as a proxy for venture capital's stage preference [5, 6].

Against this background, National Independent Innovation Demonstration Zones may shift VC entry toward earlier stages by reducing information frictions and mitigating early-stage investment risks. Conversely, by attracting mature firms, they may reinforce the concentration of capital at more mature stages. We therefore propose the following competing hypotheses:

H1a: The establishment of National Independent Innovation Demonstration Zones shifts VC entry toward earlier stages and increases the probability that younger firms receive VC investment.

H1b: The attraction effect on mature firms dominates, and the establishment of National Independent Innovation Demonstration Zones does not significantly shift VC entry toward earlier stages.

3. Research design

This paper focuses on firms' first institutional VC investment events and exploits policy variation arising from the staggered approvals of National Independent Innovation Demonstration Zones to construct a firm-level, quarterly, staggered DID model with fixed effects. We measure VC stage preferences by firms' age at first investment (Age) and by the probability of receiving the first VC investment within three years of establishment (Early3), while controlling for city, quarter, and industry fixed effects. The staggered DID specification follows the relevant literature [7], and the analysis of dynamic effects further draws on the event-study approach [8].

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Table 1. Descriptive statistics of variables

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Age	39,962	3.2466	4.0571	0.0000	19.5756
Early3	39,962	0.6648	0.4721	0.0000	1.0000
NIDZ	39,962	0.7565	0.4292	0.0000	1.0000
lnPgdp	39,962	11.5317	0.4655	7.9255	13.0557
Growth	39,962	0.0886	0.1024	-0.1030	3.3000
lnPop	39,962	6.7436	0.6147	3.0082	8.1362
Fiscal	39,962	0.1773	0.0644	0.0439	2.0603
FiscalSelf	39,962	0.8422	0.1424	0.0256	1.5413
Loan	39,962	1.8342	0.4626	0.1655	6.1930
University	39,962	5.2821	2.2047	0.1364	12.2016

Descriptive statistics indicate that sample firms are, on average, 3.2466 years old when they first receive institutional VC investment, and 66.48% receive their first investment within three years of establishment as shown in table 1.

4. Empirical analysis

4.1. Baseline regression results

Table 2. National independent innovation demonstration zones and venture capital stage preferences: baseline regression results

Variable	Age	Age	Early3	Early3
	(1)	(2)	(3)	(4)
NIDZ	-0.2788**	-0.2601**	0.0313**	0.0303**
	(-2.04)	(-2.20)	(2.06)	(2.17)
Control variables	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes

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Table 2. (continued)

Periods	76	76	76	76
Cities	273	273	273	273
Observations	39,962	39,962	39,962	39,962
R^2	0.2608	0.2615	0.2129	0.2135

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Values in parentheses are t-statistics, standard errors are clustered at the city level.

The coefficient on NIDZ in the Age regression is -0.2601 and is significant at the 5% level, indicating that, following demonstration zone approval, firms receive their first institutional VC investment approximately 0.26 years earlier on average as shown in table 2. The coefficient on NIDZ in the Early3 regression is 0.0303, also significant at the 5% level, indicating that the probability of first receiving VC investment within three years of establishment increases by approximately 3.03 percentage points. Both measures yield consistent results, supporting the hypothesis that National Independent Innovation Demonstration Zones shift VC entry toward earlier stages.

4.2. Robustness tests

To assess the reliability of the baseline results, we conduct further tests along three dimensions: replacing variables, adjusting policy timing, and changing sample definitions. The results in table 3 and 4 show that the direction of the policy variable remains consistent when alternative measures, including unwinsorized Age, ln(1+Age), and Early2, are used. Moreover, the core coefficients remain significant when we exclude the policy-approval quarter and narrow the sample to strictly defined VC and angel investments.

Table 3. Robustness tests

Variable	Macroeconomic environment controls		Alternative dependent-variable measures			
	Age (1)	Early3 (2)	Age (3)	ln(1+Age) (4)	Early2 (5)	Early5 (6)
NIDZ	0.1970	0.0038	-0.2370*	-0.0560**	0.0266*	0.0206
	(1.43)	(0.25)	(-1.88)	(-2.15)	(1.70)	(1.62)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

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Table 3. (continued)

Province × year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Periods	76	76	76	76	76	76
Cities	273	273	273	273	273	273
Observations	39,962	39,962	39,962	39,962	39,962	39,962
R^2	0.2782	0.2258	0.2515	0.2504	0.1753	0.2318

Table 4. Robustness tests

Variable	Alternative policy timing				Alternative sample definitions			
	Age (1)	Early3 (2)	Age (3)	Early3 (4)	Age (5)	Early3 (6)	Age (7)	Early3 (8)
NIDZ	-0.2267*	0.0265*	-0.2626**	0.0309**	-0.2506**	0.0296**	-0.2569**	0.0313**
	(-1.89)	(1.94)	(-2.10)	(2.14)	(-2.20)	(2.07)	(-2.37)	(2.46)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Periods	76	76	76	76	76	76	70	70
Cities	273	273	273	273	272	272	235	235
Obs.	39,962	39,962	39,235	39,235	39,404	39,404	21,558	21,558
R^2	0.2615	0.2134	0.2640	0.2154	0.2593	0.2114	0.2346	0.1935

4.3. Parallel trends and dynamic effects tests

We use an event-study approach to examine dynamic changes before and after policy implementation [8]. Taking the quarter immediately preceding the policy as the reference period, we examine dynamic effects from 12 to 2 quarters before demonstration zone approval and during the 12 quarters following approval as shown in table 5.

$$Y_{c,q}=\beta_0+\sum_{k\neq -1}\beta_k Event_{c,q}^{(k)}+\lambda Z_{c,t-1}+\mu_c+\gamma_q+\varepsilon_{c,q} \quad (1)$$

Here, $Event_{c,q}^{(k)}$ denotes the position of a city-quarter relative to the demonstration zone approval quarter, and k=-1 is the reference period.

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Table 5. Results of joint tests for parallel trends

Sample and specification	Measure	Quarterly p-value	Semiannual p-value	Test conclusion
Active city-quarter (equal-weighted)	MedianAge	0.6743	—	Fail to reject
Active city-quarter (equal-weighted)	EarlyShare	0.3126	—	Fail to reject
Active city-quarter (event-count-weighted)	MedianAge	0.0994	0.4419	Fail to reject at 5%
Active city-quarter (event-count-weighted)	EarlyShare	0.00003	0.0788	Reject at quarterly level
Full city-quarter (count panel)	FirstVCCount	0.0321	—	Reject
Full city-quarter (count panel)	Early3Count	0.0300	—	Reject
Full city-quarter (count panel)	Late3Count	0.0527	—	Fail to reject at 5%

Note: The null hypothesis of the joint test is that all pre-policy event-time coefficients are all equal to zero. Quarterly tests jointly examine quarters -12 through -2, with quarter -1 as the reference period. Semiannual tests are conducted only as supplementary tests for the event-count-weighted stage composition.

The results in figure 1 and 2 show that the null hypothesis is not rejected in the pre-policy trend tests for some stage-composition measures, while the dynamic effect plots indicate a stronger shift toward earlier stages after policy implementation.

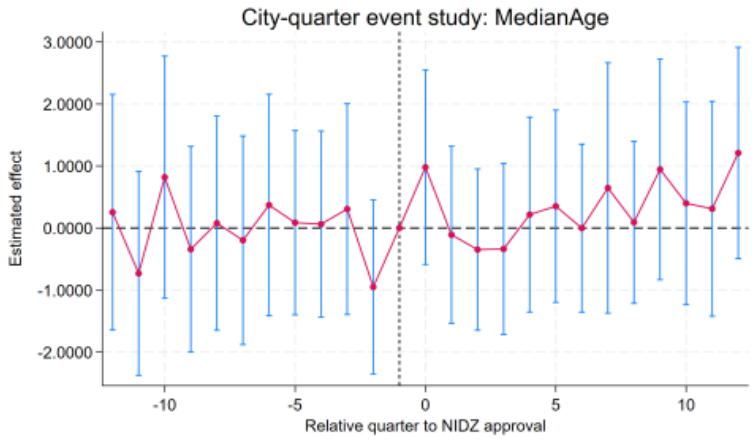


Figure 1. Dynamic effects on city–quarter MedianAge (equal weighting)

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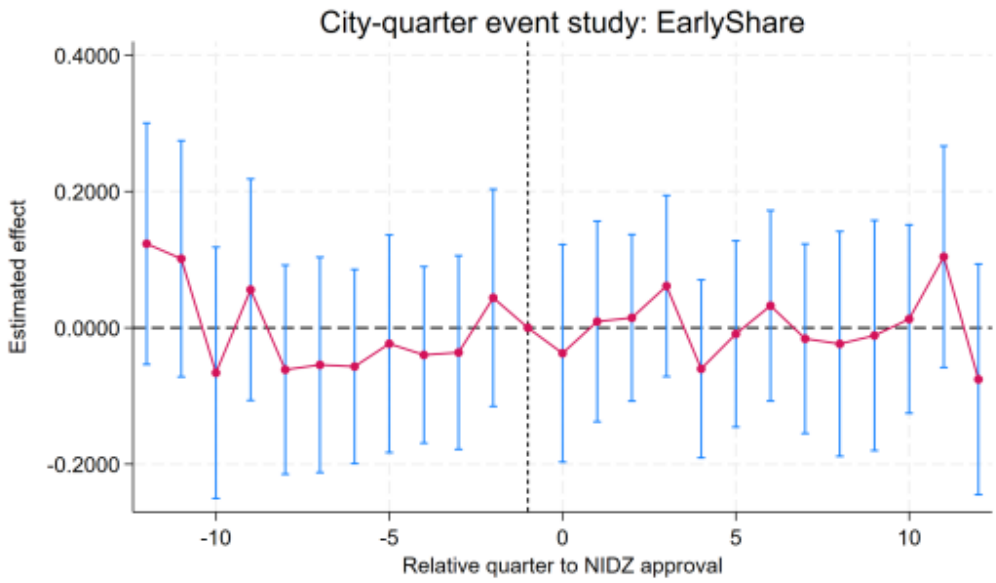


Figure 2. Dynamic effects on city–quarter EarlyShare (equal weighting)

Note: The horizontal axis represents quarters relative to the approval of National Independent Innovation Demonstration Zones, with the quarter immediately preceding approval as the reference period. Points represent estimated dynamic coefficients, and error bars indicate 95% confidence intervals.

After weighting by the number of events, the pre-policy test for MedianAge yields p=0.0994 at the quarterly frequency and p=0.4419 at the semiannual frequency, for EarlyShare, the corresponding values are p=0.00003 and p=0.0788. The pre-policy tests for FirstVCCount and Early3Count are also significant in the full count panel.

5. Mechanism tests

To identify the channels through which demonstration zones may shift VC entry toward earlier stages, we examine three mechanisms: foundational support for innovation, government risk-sharing, and the innovation information environment. We employ a two-step approach to test these mechanisms: first, we examine the effects of the policy on the mechanism variables, second, we add these variables to the firm-level model to assess their relationships with the indicators of VC investment stage.

$$M_{c,t}=\beta_0+\beta_1 NIDZ_{c,t}+\lambda Z_{c,t-1}+\mu_c+\gamma_t+\varepsilon_{c,t} \quad (2)$$

$$Y_i=\theta_0+\theta_1 NIDZ_{c,q(i)}+\theta_2 M_{c,t(i)}+\lambda Z_{c,t(i)-1}+\mu_c+\gamma_q+\eta_j+\varepsilon_i \quad (3)$$

5.1. Foundational support for innovation

Demonstration zones may ease the financing constraints of early-stage firms by increasing fiscal expenditure on science and technology and by developing innovation service systems. We measure foundational support for innovation by the share of fiscal expenditure allocated to science and technology (TechFiscal).

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Table 6. Effects of national independent innovation demonstration zones on mechanism variables

Mechanism variable	Main specification (1)	Approval-year specification (2)	Observations	R^2
S&T fiscal expenditure share	0.0122***	0.0121***	5,156	0.7563
	(6.22)	(5.90)		
Government guidance fund stock	0.1312***	0.1411***	5,187	0.7427
	(3.97)	(4.02)		
ln(1+invention patents granted)	0.1971**	0.1877**	1,867	0.9500
	(2.05)	(2.44)		
ln(1+all patents granted)	-0.1514***	-0.0910*	1,871	0.9530
	(-2.96)	(-1.77)		

Table 6 shows that the coefficients on NIDZ for TechFiscal are 0.0122 and 0.0121 under the full-year and approval-year specifications, respectively, both of which are statistically significant at the 1% level. This indicates a consistently positive association between demonstration zone approval and the share of fiscal expenditure allocated to science and technology.

5.2. Government risk-sharing mechanism

Government guidance funds may alleviate market-oriented investors' concerns about investing in early-stage firms through risk-sharing and by leveraging additional capital according to table 7.

Table 7. Second-Step mechanism tests for foundational support for innovation and government risk-sharing

Mechanism variable	Mechanism timing	Mechanism coef. (Age model)	Mechanism coef. (Early3 model)	NIDZ coef. (Age model)	NIDZ coef. (Early3 model)
S&T fiscal expenditure share	Contemporaneous	-3.4126*	0.1581	-0.2289**	0.0289**
		(-1.86)	(0.82)	(-2.00)	(2.15)
S&T fiscal expenditure share	Lagged one period	-2.5022	0.1051	-0.2214*	0.0283*
		(-0.70)	(0.24)	(-1.94)	(1.94)

DOI: 10.54254/2754-1169/2026.AB39009

Table 7. (continued)

Government guidance fund stock	Contemporaneous	-0.4108**	0.0097	-0.2211*	0.0294**
		(-2.33)	(0.38)	(-1.90)	(2.04)
Government guidance fund stock	Lagged one period	-0.4560***	0.0245	-0.1915*	0.0264*
		(-2.81)	(0.99)	(-1.66)	(1.83)

Overall, the evidence primarily supports government risk-sharing as the channel linking demonstration zones to VC stage preferences, while the foundational support for innovation mechanism receives limited support.

6. Research conclusions and policy implications

The study yields the following findings. First, the establishment of National Independent Innovation Demonstration Zones is significantly and positively associated with a shift in VC entry toward earlier stages. After demonstration zone approval, firms receive their first institutional VC investment 0.26 years earlier on average, and the probability of receiving first VC investment within three years of establishment increases by 3.03 percentage points.

Mechanism analysis indicates that government risk-sharing is the main channel supported by the evidence. Demonstration zones are significantly associated with the expansion of government guidance funds, which may help reduce market-oriented investors' concerns about investing in early-stage firms by sharing investment risks [9].

Third, the policy effect is subject to certain boundary conditions. The association with earlier-stage VC entry is more pronounced in regions with a weaker VC base, in industries with lower investment activity, and in financing events without direct participation by state-backed institutions.

In terms of policy implications, evaluations of innovation policy should consider not only growth in the scale of capital but also the stage structure of capital entry over the firm life cycle. Going forward, government guidance funds and the technology finance system should be further improved to encourage market-oriented capital to participate in early-stage innovation projects through risk-sharing mechanisms [10]. At the same time, differentiated policies should be implemented according to regional foundations for innovation finance, and mechanisms for identifying and evaluating early-stage projects and connecting them with financing should be strengthened.

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DOI: 10.54254/2754-1169/2026.AB39009

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