Financial Economics Research; Vol.3, No.4; 2026
E-ISSN: 3006-3663 P-ISSN: 3006-3655
DOI: https://doi.org/10.70267/fer.v3n4.97110
Published by: Zeus Press

Science and Technology Finance Pilot Policy and Corporate Long-term Investment: Evidence from China

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Abstract

The science and technology finance pilot policy is a key institutional effort to integrate technological innovation with financial services. Its microeconomic effects have drawn growing academic interest. Using data from Chinese A-share listed firms from 2007 to 2023, this paper treats the policy as a quasi-natural experiment and employs a staggered difference-in-differences model. We examine how the policy affects corporate long-term investment. The results show that the policy significantly increases long-term investment among firms in pilot cities. Mechanism tests indicate that higher R&D investment serves as an important channel. Heterogeneity analysis further shows that the positive effect is statistically significant among non-state-owned firms and manufacturing firms. Regional interaction estimates indicate that the policy effect is stronger in the Yangtze River Delta and weaker in the Pearl River Delta relative to their respective comparison regions. This paper enriches the literature on the micro-level outcomes of science and technology finance policies and offers empirical evidence on how policy guidance shapes corporate investment structures.

Keywords

science and technology finance pilot policy, long-term investment, staggered DID, R&D innovation, Chinese A-share listed companies

1. Introduction

The world today is undergoing rapid and profound changes. External conditions have become more unstable, uncertain, and unpredictable. These factors add to the downward pressure on China's economy. Against this backdrop, a key question is how to energize micro-level actors, stabilize corporate investment expectations, and channel capital toward long-term and productive uses. Since 2011, Chinese Ministry of Science and Technology, together with other agencies, has launched two rounds of pilot cities to promote the integration of science and technology with finance. These pilots use various policy tools, including specialized financial institutions, innovative credit products, and risk compensation mechanisms, to direct financial resources toward the technology sector. In 2023, the Central Financial Work Conference placed science and technology finance at the top of its five priority areas, highlighting its strategic significance.

Long-term investment underpins a firm's ability to accumulate technological capital and sustain competitive advantage. Its level and composition depend not only on internal resources and strategy but also on external financing conditions and policy incentives [1]. When macroeconomic uncertainty rises and traditional finance falls short of supporting technology-oriented firms, long-term investment often suffers first. Can the science and technology finance pilot policy, as a deliberate institutional intervention, effectively encourage firms to increase long-term investment? This is the central question we address.

To address this gap, we construct a staggered DID model using data on A-share listed firms from 2007 to 2023. Our dependent variable is corporate long-term investment. Our key independent variable is whether a firm's city was selected as a pilot. To account for implementation lags, we set the effective policy year as 2012 for the first batch announced in 2011, and 2017 for the second batch announced in 2016. We control for firm size, leverage, return on assets, revenue growth, cash flow ratio, and largest shareholder ownership. We also include firm and year fixed effects to reduce omitted-variable bias. Our findings are as follows. First, the pilot policy significantly raises long-term investment in treated firms. This result survives parallel trend tests and a series of robustness checks. Second, the mechanism works through increased R&D investment. By improving financing conditions and expanding access to credit and venture capital, the policy encourages more R&D spending, which in turn shifts investment toward longer-term horizons. Third, the effect is significant for non-state-owned and manufacturing firms. The regional interaction estimates show a relatively larger policy effect in the Yangtze River Delta and a relatively smaller effect in the Pearl River Delta than in their respective comparison regions; they do not establish an absolute ranking of within-region policy effects.

This paper contributes to the literature in three ways. First, it extends the study of science and technology finance to the domain of long-term investment structure. Unlike prior work that focuses on financing constraints or R&D, we disaggregate long-term investment to provide a finer-grained analysis. Second, our staggered DID design offers a cleaner policy evaluation and mitigates endogeneity concerns, adding credible evidence on the effectiveness of policy tools like government-guided funds and technology credit. Third, our results carry practical policy implications. We show that the policy not only boosts long-term investment but also steers capital toward the real economy, offering micro-level support for expanding pilot programs, refining policy design, and countering financialization trends.

2. Literature Review and Theoretical Foundation

2.1 Literature Review

Existing studies have examined the effects of science and technology finance from various perspectives. Macro-level research finds that it promotes regional innovation and industrial upgrading [2]. Micro-level studies show that it eases financing constraints, boosts R&D spending, and raises total factor productivity [3, 4]. More recent work directly evaluates China's science and technology finance pilot policy. Wang and Cao [5] find that the policy tools significantly promote regional technological innovation, with credit support and government-guided funds being the most effective channels. Yang and Xu [6] show that the policy contributes to inclusive green growth in pilot cities by improving resource allocation and encouraging sustainable development. Yang and Wang [7] examine the synergistic effect of science and technology finance policy and green finance policy, finding that the combination enhances corporate ESG performance and promotes long-term sustainable investment.

However, most of this work focuses on regional innovation, green growth, or ESG outcomes. Few studies take a systematic look at corporate long-term investment structures, which include R&D, capital expenditure, and fixed asset investment. These different forms reflect different strategic choices, whether a firm prioritizes technological accumulation or physical capital expansion. Prior studies have examined how institutional environments affect investment efficiency, and how managerial traits shape long-term investment decisions. Yet we still know little about how the science and technology finance policy affects the overall structure of long-term investment. More importantly, given the policy goal of preventing the economy from shifting from real to virtual activities, does this policy encourage firms to invest in productive long-term assets, or does it merely free up funds for other purposes? The financialization literature has documented that rising financial asset holdings undermine real investment, and that complex links exist between financial asset allocation and corporate leverage [8, 9]. These studies lay important groundwork, but the specific effect of the science and technology finance pilot on long-term investment structure still awaits rigorous testing.

2.2 Theoretical Foundation and Research Hypotheses

The science and technology finance pilot policy aims to integrate technology with finance. Its core objective is to ease financing constraints for technology-oriented firms and encourage them to invest in long-term, productive activities. How does this policy affect long-term investment through various channels? Do the effects differ by firm ownership, region, or industry? In this section, we draw on information asymmetry theory, signaling theory, financing constraint theory, and resource dependence theory to analyze the mechanisms and develop our hypotheses.

2.2.1 Science and Technology Finance Policy and Corporate Long-Term Investment

Long-term investment includes capital spending for capacity expansion and R&D spending for innovation. These decisions are critical for a firm's long-term competitiveness and sustainability [10]. However, such investments are typically long-cycle, high-risk, and costly to adjust. They are therefore highly sensitive to external financing conditions. When facing tight financing constraints, firms often cut long-term investment and turn to short-term financial assets instead [8, 9]. The science and technology finance pilot policy can improve the financing environment in several ways. Recent studies on this policy provide supporting evidence. Wang and Cao [5] find that credit support and government-guided funds are the most effective policy tools for promoting regional technological innovation. Yang and Xu [6] show that the policy improves resource allocation efficiency and encourages sustainable development. Yang and Wang [7] demonstrate that the policy works synergistically with green finance to promote corporate ESG performance and long-term sustainable investment.

First, the policy reduces information asymmetry. Specialized credit institutions and third-party evaluation mechanisms help bridge the gap between banks and firms, making lenders more willing to provide long-term credit to technology firms. This is consistent with the logic in Petersen and Rajan [11] and Stiglitz and Weiss [12], where information frictions in credit markets distort capital allocation. Second, the policy sends a positive signal. Pilot city designation serves as a government endorsement. It tells external investors that the area has strong technological potential and policy support. This signaling effect is well documented in the corporate finance literature on government subsidies and policy interventions [13, 14]. Third, the policy provides direct resources. Government-guided funds and interest subsidies lower the marginal cost of long-term investment [15]. Wang and Cao [5] confirm that these resource-providing channels are particularly effective in stimulating innovation. In sum, the science and technology finance pilot policy can incentivize long-term investment by easing financing constraints, sending favorable signals, and providing resources. We therefore propose the following hypothesis.

H1: The science and technology finance pilot policy significantly increases corporate long-term investment.

2.2.2 Mechanism Channel: R&D Investment

We focus on R&D innovation as the core mechanism. R&D spending is both a component of long-term investment and a key measure of policy effectiveness. The science and technology finance policy reduces the financial risks and adjustment costs of R&D through low-cost funds, tax incentives, and risk sharing. This encourages firms to spend more on R&D. More specifically, the policy expands financing options for innovation. Specialized credit institutions, venture capital development, and intellectual property pledge financing all help lower the external cost of R&D funding. When firms have more stable and ample funding, they become both more willing and more able to invest in R&D. This logic aligns with the findings of Brown et al. [16], who show that equity markets and credit availability are critical for R&D investment, and Aghion et al. [17], who demonstrate that credit constraints dampen innovation. Wang and Cao [5] further confirm that credit support and government-guided funds serve as key transmission channels for the policy's effects on technological innovation.

Higher R&D investment directly raises long-term investment levels. It also indirectly supports long-term investment through technological accumulation and improved innovation capacity. These arguments support our proposed mechanism. We therefore propose the following hypothesis.

H2: Higher R&D investment is an important channel through which the science and technology finance policy promotes corporate long-term investment.

2.2.3 Heterogeneous Effects

The policy effect may vary by ownership type, region, and industry. First, ownership. Non-state-owned firms face greater disadvantages in financing access, policy support, and government endorsement. Their long-term investment depends more heavily on external financing. State-owned firms, by contrast, tend to maintain long-term investment for political and social reasons. Their investment decisions are less sensitive to policy changes. This ownership-based heterogeneity is consistent with the broader literature on state versus private ownership in emerging markets [18, 19]. Yang and Xu [6] find that the policy's effects on resource allocation and green growth vary significantly across regions with different levels of market development, implying that firms in more market-oriented regions may benefit differently. Thus, the policy effect may differ by ownership type.

Second, region. The Yangtze River Delta is one of China's most developed regions, with abundant financial resources, high marketization, and strong policy implementation capacity. Technology firms are concentrated there, and policy transmission may be efficient. These conditions may shape how policy effects compare across regions. This regional variation reflects the uneven development of financial markets and institutional quality across Chinese regions [20]. Yang and Xu [6] provide evidence that the policy's effects on inclusive green growth vary with financial infrastructure and economic development. Third, industry. Manufacturing firms have higher capital needs, longer payback periods, and greater pressure to upgrade equipment and technology. Their long-term investment is more sensitive to financing conditions. The policy improves their access to credit, guarantees, venture capital, and IP pledge financing. This reduces uncertainty and encourages them to allocate more resources to long-term production and development. Non-manufacturing firms have more varied asset structures and investment cycles. Some are asset-light and have lower fixed investment needs, so the policy's marginal effect may be smaller. This industry variation is consistent with evidence that manufacturing is particularly responsive to financial development [21, 22]. We therefore propose the following hypothesis.

H3: The positive effect of the science and technology finance policy on long-term investment is stronger for non-state-owned firms, firms in the Yangtze River Delta, and manufacturing firms.

3. Methodology

3.1 Model Specification

To effectively test the impact of science and technology finance policies on firms' long-term investment, this study treats these policies as a quasi-natural experiment. Given the variations in science and technology finance policies across different cities and pilot years, a multi-period difference-in-differences model is constructed for empirical analysis. The specific model specification is as follows:

$$LInv_{it} = \beta_0 + \beta_1 DID_{it} + \gamma Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \tag{1}$$

In Equation (1), i and t represent the firm and the year, respectively; The dependent variable represents firm i's long-term investment in period t. The key explanatory variable is a dummy variable indicating whether the city implemented the science and technology finance pilot policy; it is set to 1 if the policy was implemented and 0 otherwise. serves as a control variable; and represent firm-level and time-level fixed effects, respectively, to account for firm-specific characteristics that do not change over time and macroeconomic shocks that vary over time; is the random error term, and robust standard errors clustered at the city level are used.

3.2 Selection of Variables

3.2.1 Dependent Variables

Corporate Long-term Investments (Long-term Investments, LInv)

A firm's long-term investments refer to internal, operational investments that generate economic returns over a period exceeding one fiscal year. Drawing on the research by Chen Deqiu and Zhong Yunjia [23] and Hu Nan et al. [24], this study measures a firm's long-term investments as the ratio of the sum of the firm's R&D expenditures and capital expenditures to its total assets. Here, a firm's R&D expenditures refer to its R&D expenses for the current year; missing R&D expense data are replaced with 0.

3.2.2 Core Explanatory Variables

Science and Technology Finance Pilot Policy (DID)

This variable is constructed as the interaction between city-grouping dummy variables and a policy-implementation-time dummy variable. If a firm's city is selected as a pilot city for "Promoting the Integration of Science, Technology, and Finance", the DID takes a value of 1 in the year of policy implementation and subsequent years; otherwise, it is 0.The Science and Technology-Finance Pilot Policy is a systematic policy established to promote the deep integration of scientific and technological innovation with financial services. In 2011, the Ministry of Science and Technology and other departments proposed and announced the first batch of 41 pilot cities; in 2016, the second batch of 8 pilot cities was announced. Among these, Ningbo was included in both batches but was ultimately counted as part of the first batch of pilot cities. Due to the time lag associated with the science and technology finance pilot policy, this paper defines 2012 as the policy implementation year for the first batch of pilot cities and 2017 as the policy year for the second batch.

3.2.3 Control Variables

Since firms' long-term investments are influenced by a variety of other factors, this paper introduces a series of control variables, including firm size (Size), debt-to-asset ratio (Lev), return on assets (ROA), revenue growth rate (Growth), cash flow ratio (Cashflow), and the largest shareholder's equity ratio (CR1). The definitions of these variables are presented in Table 1.

Table 1: Variable Definitions

Variable Category	Variable Name	Variable Symbol	Variable Definition
Dependent Variable	Corporate Long-Term Investments	LInv	(R&D Expenditures + Capital Expenditures) / Total Assets
Core Explanatory Variables	Science and Technology Finance Pilot Policies	DID	Equals 1 if the firm is located in a pilot city in the effective policy year or thereafter, and 0 otherwise.
Control Variables	Enterprise Size	Size	Ln(Total Assets)
	Debt-to-Asset Ratio	Lev	Total Liabilities / Total Assets
	Return on Assets	ROA	Net Income / Average Total Assets
	Revenue Growth Rate	Growth	(Current-Year Revenue – Prior-Year Revenue) / Prior-Year Revenue
	Cash Flow Ratio	Cash Flow	Net Cash Flow from Operating Activities / Total Assets
	Largest Shareholder's Ownership Percentage	CR1	Number of shares held by the largest shareholder / Total issued shares of the company

3.3 Sample Selection and Data Sources

This study uses Chinese A-share listed companies from 2007 to 2023 as the research sample. To ensure the validity of the data and the reliability of the empirical results, this study excludes companies in the financial sector, as well as those designated as "ST" or "*ST " or those at risk of delisting, in order to prevent the financial conditions of such companies from influencing the final empirical results; Additionally, samples with severe missing data for key variables were excluded. To eliminate the impact of extreme outliers on the regression results, all continuous variables were winsorized at the 1% and 99% quantiles. After the aforementioned data processing, a final sample of 39,330 observations was obtained. The descriptive statistics are presented in Table 2. Firm-level data were sourced from the Guotai-An database (CSMAR), while macroeconomic data were drawn from the *China Regional Economic Statistical Yearbook* and the statistical yearbooks of various provinces.

Table 2: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Median	Maximum
LInv	39,330	0.0955	0.0778	0.00359	0.0747	0.418
did	39,330	0.555	0.497	0	1	1
Size	39,330	22.14	1.283	19.92	21.93	26.21
Lev	39,330	0.396	0.199	0.0490	0.385	0.871
ROA	39,330	0.0375	0.0616	-0.230	0.0374	0.201
Growth	39,330	0.131	0.223	-0.268	0.0833	1.213
Cash Flow	39,330	0.0477	0.0666	-0.146	0.0464	0.239
CR1	39,330	0.339	0.145	0.0837	0.317	0.730

Looking at the dependent variable, the mean value of firms' long-term investment level (LInv) is 0.0955, with a standard deviation of 0.0778, a minimum value of 0.00359, and a maximum value of 0.418. This indicates that the long-term investment levels of the sample firms are generally moderate, but there are significant differences among firms, with some firms allocate a relatively high proportion of their assets to long-term investment activities.

4. Empirical Results and Analysis

4.1 Baseline Regression

Table 3 presents the baseline regression results for the impact of science and technology finance policies on firms' long-term investment. As shown in the table, the regression coefficient for the effect of science and technology finance policies on long-term investment is 0.0091, with a significance level of 1%. Factors such as firm size, debt-to-asset ratio, and cash flow may influence whether a firm is located in a pilot city and may also directly affect its long-term investment.

Table 3: Results of the Baseline Regression

	(1) Long-Term Investment	(2) Long-Term Investment
did	0.0091***	0.0090***
	(0.0034)	(0.0034)
Constant	0.1029***	0.1226***
	(0.0323)	(0.0310)
Control variable	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Industry × Year Fixed Effects	No	Yes
N	39,330	39,330
R^2	0.642	0.647

Note: Control variables in the table include firm size, debt-to-asset ratio, return on assets, growth, cash flow ratio, and the largest shareholder's ownership percentage. The same applies below.

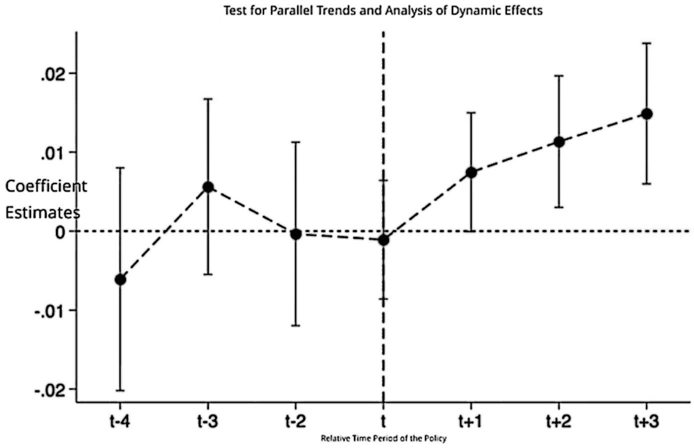
4.2 Robustness Tests

4.2.1 Parallel Trends Test

To ensure the validity of the estimates from the difference-in-differences model, a key prerequisite is compliance with the parallel trends assumption. Specifically, prior to policy implementation, the dependent variables in the treatment group and the control group must exhibit consistent trends. This study employs the event study method to conduct the parallel trends test. Since the period immediately preceding policy implementation is typically designated as the baseline, this study sets the period immediately prior to policy implementation (t-1) as the baseline. Figure 1 presents the results of the parallel trends test and dynamic effects analysis regarding the impact of technology finance policies on firms' long-term investment.

Figure 1 shows that for periods t-4, t-3, and t-2—prior to the implementation of the technology finance policy—the 95% confidence intervals for the estimated coefficients in each period include zero. The estimated coefficients for each period prior to policy implementation are not significantly different from zero, indicating that there are no systematic differences in investment levels between firms in the treatment group and the control group. This satisfies the parallel trends assumption of the difference-in-differences model, confirming the validity of this study's design. In the period of policy implementation (t), the estimated coefficients for the dependent variables were all close to zero and statistically insignificant. The policy effects had not yet fully manifested in the year of implementation, which aligns with the reality that a certain transmission period is required from policy announcement to implementation. In the periods following policy implementation—t+1, t+2, and t+3—the estimated coefficients show a gradual upward trend. In terms of long-term investment, the coefficients for each period after policy implementation remain consistently positive and gradually increase, reaching a level of approximately 0.015 by period t+3. These patterns indicate that the promotional effect of science and technology finance policies on firms' long-term investment levels will continue to unfold as the policy is further advanced and supporting measures are gradually improved.

Figure 1: Test for Parallel Trends and Analysis of Dynamic Effects



4.2.2 PSM-DID

To further mitigate potential sample selection bias between firms in the treatment and control groups prior to policy implementation, this study employs a combined approach of propensity score matching and difference-in-differences (DID) for robustness testing. Specifically, the sample is first matched based on firm-level characteristics to enhance comparability between the treatment and control groups; the impact of the science and technology finance pilot policy on firms' investment structure is then re-estimated using the matched sample. The regression results show that, in the matched sample, the estimated coefficient of the core explanatory variable `did` for firms' long-term investment is 0.009 and is significantly positive at the 1% level. This indicates that, after controlling for sample selection bias, the science and technology finance pilot policy still significantly promotes firms' long-term investment.

Table 4: PSM-DID Regression Results

	(1) Firm Long-Term Investment
did	0.009^{***}
	(3.075)
Control variables	Yes
Year fixed	Yes
Industry fixed	Yes
_cons	0.103^{***}
	(3.099)
N	30,548

Note: t-statistics are reported in parentheses.

As shown in Table 4, the signs and significance of the key variables in the PSM-DID regression are largely consistent with those in the baseline regression, indicating that the findings of this study are not driven by initial differences in firm characteristics between the treatment and control groups. In other words, the science and technology finance pilot policy can guide firms to increase long-term investment by improving their financing environment and enhancing the efficiency of financial resource allocation. Overall, the PSM-DID test further validates the robustness of the study's findings.

4.2.3 Varying the Sample Size

To test the robustness of the research findings, this study examines whether the regression results remain consistent by shortening the sample period. Given the impact of the 2020 COVID-19 pandemic, the sample period was shortened to 2007–2019 to prevent severe distortions in firm behavior during the pandemic. Table 5 presents the regression results after shortening the sample period. Compared with the baseline regression results in Table 3, the estimated coefficients for the core explanatory variable "did" remain positive in the long-term investment regression and all pass the significance test. Overall, the estimation results after shortening the sample period are largely consistent with the conclusions of the baseline regression, further validating the robustness of this study's findings.

Table 5: Regression Results After Shortening the Sample Period

	(1) Long-Term Investments	(2) Long-Term Investments
did	0.0107***	0.0107***
	(0.0040)	(0.0040)
Constant	0.0953**	0.1255***
	(0.0463)	(0.0440)
Control variables	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Industry × Year Fixed Effects	No	Yes
N	16,997	16,997
R^2	0.630	0.637

4.3 Heterogeneity Analysis and Mechanism Analysis

4.3.1 Heterogeneity in Ownership Structure: State-Owned Enterprises and Non-State-Owned Enterprises

To examine the differing effects of the science and technology finance pilot policy on long-term investment in enterprises with different ownership structures, this paper further divides the sample into state-owned enterprises and non-state-owned enterprises to conduct group-specific regressions. The regression data in Table 6 show that, in the state-owned enterprise sample group, the estimated coefficient of the DID variable corresponding to the science and technology finance pilot policy on long-term investment is 0.0040. Although the coefficient is positive, it did not pass the significance test. In terms of policy effects, the impact of the science and technology finance pilot policy on long-term investment in state-owned enterprises is not significant. In the sample of non-state-owned enterprises, the estimated coefficient of the DID variable for long-term investment is 0.0132, which is significantly positive at the 5% level. This demonstrates that the science and technology finance pilot policy can increase the level of long-term investment in non-state-owned enterprises.

Table 6: Regression Results for Ownership Heterogeneity

	(1)	(2)
	State-Owned Enterprises Long-Term Investment	Non-state-owned enterprises Long-term Investments
did	0.0040	0.0132**
	(0.0045)	(0.0052)
Control variable	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Constant	0.0825*	0.0768*
	(0.0494)	(0.0432)
N	9,978	20,505
R^2	0.603	0.642

4.3.2 Regional Heterogeneity: The Yangtze River Delta and the Pearl River Delta

To further examine how the effect of the science and technology finance pilot policy varies across regions, this paper uses the Yangtze River Delta and the Pearl River Delta as representative regional samples. For each region, we construct a regional dummy variable that equals 1 if a firm is located in that region and 0 otherwise, and we estimate a fully interacted model in which this regional dummy is interacted with the policy variable did. In this specification, the coefficient on did captures the policy effect for firms located outside the region, while the coefficient on the interaction term measures the difference in the policy effect between firms located inside and outside the region. The results are reported in Table 7. In the Yangtze River Delta specification, the interaction term is positive and statistically significant, indicating that the policy effect on corporate long-term investment is significantly stronger for firms in the Yangtze River Delta than for firms in other regions. In the Pearl River Delta specification, the interaction term is negative and statistically significant, indicating that the policy effect is significantly weaker for firms in the Pearl River Delta than for firms in other regions.

Table 7: Regional Heterogeneity Regression Results

	(1) Yangtze River Delta: Long-Term Investment	(2) Pearl River Delta: Long-Term Investment
did	0.0040	0.0101**
	(0.0047)	(0.0040)
Yangtze River Delta × did	0.0122*	
	(0.0073)	
Pearl River Delta × did		-0.0172*
		(0.0094)
Control variables	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Constant	0.0907***	0.0905***
	(0.0028)	(0.0023)
N	39,070	39,070
R2	0.5475	0.5476

Note: The regional heterogeneity tests are based on interaction models. The coefficient on did measures the policy effect for firms outside the region, and the coefficient on the interaction term measures the difference in the policy effect between firms inside and outside the region, rather than the policy effect within the region itself.

Column (1) of Table 7 reports the results for the Yangtze River Delta. The coefficient on DID, which captures the policy effect for firms outside the Yangtze River Delta, is 0.0040 and statistically insignificant. The interaction term between the Yangtze River Delta dummy and DID is 0.0122 and is significant at the 10% level, indicating that the policy effect is significantly stronger in the Yangtze River Delta than in other regions. The implied policy effect for firms in the Yangtze River Delta is 0.0161 (0.0040 + 0.0122), and the linear combination test shows that this effect is statistically significant at the 5% level ($p = 0.011$). These results suggest that the regional financial ecosystem, innovation resource concentration, and industrial collaboration networks in the Yangtze River Delta may enhance the transmission of science and technology finance policies.

Column (2) reports the results for the Pearl River Delta. The coefficient on DID, which captures the policy effect for firms outside the Pearl River Delta, is 0.0101 and statistically significant at the 5% level. However, the interaction term between the Pearl River Delta dummy and DID is -0.0172 and significant at the 10% level, indicating that the policy effect is significantly weaker in the Pearl River Delta than in other regions. The implied policy effect for firms in the Pearl River Delta is -0.0071. However, the linear combination test shows that this effect is not statistically significant ($p = 0.431$). Therefore, the results should not be interpreted as evidence that the policy significantly reduces long-term investment in the Pearl River Delta; rather, they indicate that the policy does not generate a statistically significant positive effect within the region.

Overall, the heterogeneity results provide partial support for H3. The policy effect is statistically significant among non-state-owned and manufacturing firms, while the regional interaction analysis provides direct evidence that the effect is stronger in the Yangtze River Delta than in other regions.

4.3.3 Sectoral Heterogeneity: Manufacturing and Non-Manufacturing

To further examine the impact of the science and technology finance pilot policies on the long-term investment of enterprises in different sectors, this paper divides the sample into manufacturing and non-manufacturing enterprises based on their industry classification. The regression results in Table 8 show that, in the manufacturing sample, the estimated coefficient of the core explanatory variable `did` for long-term investment is 0.0079, and it is significantly positive at the 5% level. This indicates that the science and technology finance pilot policies can significantly promote an increase in long-term investment by manufacturing enterprises.

In contrast, in the non-manufacturing sample, the estimated coefficient of `did` for firms' long-term investment is 0.0068; although the coefficient is positive, it does not pass the significance test. This suggests that the impact of the science and technology finance pilot policies on the investment structure of non-manufacturing firms is relatively limited and has not yet demonstrated a significant stimulatory effect.

Table 8: Results of the Industry-Specific Regression

	(1) Manufacturing Long-Term Investment	(2) Non-manufacturing Long-term investments
did	0.0079**	0.0068
	(0.0035)	(0.0067)
Control variable	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Constant	0.0872**	0.2244***
	(0.0384)	(0.0469)
N	22551	7941
R^2	0.635	0.682

From an economic perspective, manufacturing enterprises typically have greater capital investment needs, longer payback periods, and face greater pressure to upgrade technology and replace equipment; as a result, they are more susceptible to the impact of external financing when making long-term investments.Pilot policies for science and technology finance can improve the availability of financing for manufacturing enterprises and reduce the uncertainty associated with long-term investment, thereby guiding enterprises to allocate more resources to actual production and long-term development activities. The asset structures, investment cycles, and financing needs of non-manufacturing enterprises are relatively more diverse; some enterprises may be characterized by lighter asset bases or lower fixed-asset investment needs, so the marginal promotional effect of science and technology finance policies on their long-term investment is not significant.

Overall, the impact of the science and technology finance pilot policy on corporate long-term investment exhibits considerable heterogeneity. The policy effect is statistically significant among non-state-owned enterprises and manufacturing firms. Regional interaction tests further show that the policy effect is significantly stronger in the Yangtze River Delta and significantly weaker in the Pearl River Delta relative to their respective comparison regions. These findings suggest that ownership characteristics, regional financial conditions, and industry-specific financing needs may shape the transmission of science and technology finance policies.

4.3.4 Analysis of R&D Innovation Mechanisms

To further examine the mechanism through which the science and technology finance pilot policy affects firms' long-term investment, this paper conducts a regression analysis using the proportion of R&D expenditure as the mechanism variable. The results show that in Column (1), after simultaneously controlling for firm fixed effects, year fixed effects, and the industry-year interaction fixed effects, the estimated coefficient of the core explanatory variable did is 0.0026 and is significantly positive at the 10% level; In Column (2), without controlling for the industry-year interaction fixed effects, the estimated coefficient of `did` was also 0.0026 and remained significantly positive at the 10% level. This indicates that the science and technology finance pilot policies can significantly increase the proportion of R&D expenditure in enterprises, suggesting that firms are more inclined to increase R&D investment following the implementation of these policies.

Table 9: Regression Results for the Analysis of the R&D Expenditure Mechanism

	(1) R&D Expenditure as a Percentage of Revenue	(2) R&D Expenditure as a Percentage of Revenue
did	0.0026*	0.0026*
	(0.0015)	(0.0015)
Control variable	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Industry × Year Fixed Effects	Yes	No
_cons	-0.0052	-0.0100
	(0.0175)	(0.0147)
N	31,357	31,356
R^2	0.824	0.828

Corporate R&D expenditures generally exhibit distinct long-term and industrial characteristics, guiding companies to allocate more resources toward core business activities such as technological innovation, product upgrades, and improvements in production efficiency. Increasing corporate R&D investment levels is likely the primary mechanism through which the pilot policies for science and technology finance will take effect. Once implemented, these policies will drive companies to expand the scale of their long-term and industrial investments, ultimately leading to an optimization of the investment structure.

5. Conclusions and Significance

5.1 Research Findings

This paper selects Chinese A-share listed companies from 2007 to 2023 as the research sample, classifies the science and technology finance pilot policy as a quasi-natural experiment, and employs a multi-period difference-in-differences model to analyze the actual impact of this policy on corporate long-term investment. Empirical results show that the tech-finance pilot policy can drive an increase in the scale of firms' long-term investment. Empirical results show that the science and technology finance pilot policy significantly increases firms' long-term investment. The robustness tests, including PSM-DID estimation and shortening the sample period, yield results that are consistent with the baseline findings.

After examining the mechanism of action, this paper found that the science and technology finance pilot policies can increase the proportion of R&D expenditure in firms. As the scale of R&D investment rises, firms allocate more resources to technological innovation, product upgrades, and real-economy production activities, thereby driving the optimization of their investment structure. After conducting a heterogeneity analysis, this study found that the effects of the science and technology finance pilot policies are not uniform. The heterogeneity analysis shows that the policy effect is statistically significant among non-state-owned enterprises and manufacturing firms. Moreover, the regional interaction analysis indicates that the effect is significantly stronger in the Yangtze River Delta and significantly weaker in the Pearl River Delta relative to their respective comparison regions. These differences in effectiveness arise because science and technology finance policies are more likely to have a positive impact on enterprise groups facing stronger financing constraints, operating in a more favorable environment for financial innovation, and exhibiting higher demand for real-economy investment.

The findings of this study indicate that the implementation of science and technology finance pilot policies can raise firms' long-term investment levels and support the optimization of corporate investment structures, which may contribute to high-quality economic development.

5.2 Policy Recommendations

First, the science and technology finance policy framework should be continuously improved to enhance support for enterprises' long-term development. Analysis of the research data in this paper reveals that pilot science and technology finance policies can drive growth in long-term corporate investment. The government should review the implementation experiences of existing pilot programs to optimize the design of science and technology finance policies. Particular emphasis should be placed on strengthening policy funding support for long-term projects such as corporate R&D and innovation, equipment upgrades, technological retrofits, and fixed-asset investment, thereby rationally guiding the allocation of financial resources so that science and technology finance can better support corporate innovation and industrial upgrading.

Second, the targeting of science and technology finance policies should be adjusted to prioritize resources for non-state-owned enterprises, which face greater financing constraints. Results from the heterogeneity analysis show that the policy effect is statistically significant among non-state-owned enterprises, suggesting that these firms may be particularly responsive to improvements in the external financing environment. As the government advances technology finance policies, it should appropriately lower financing access requirements for private enterprises and small and medium-sized technology firms, improve credit evaluation systems and information-sharing mechanisms to reduce information asymmetries between financial institutions and enterprises, expand the coverage of loan interest subsidies for technology-based enterprises, refine risk compensation mechanisms, encourage banks to establish specialized technology finance institutions, and guide financial institutions to increase support for non-state-owned enterprises' long-term investments and R&D innovation activities.

Third, as localities implement technology finance policies, they should align these efforts with their own developmental strengths while simultaneously strengthening the regional financial ecosystem. The regional heterogeneity results show that the policy effect is particularly strong in the Yangtze River Delta region. The region's solid financial foundation, concentrated innovation resources, and smooth industrial collaboration environment all enhance the practical effectiveness of these policies. In the subsequent rollout of such policies, the government should not simply apply a one-size-fits-all policy template but rather design differentiated policies tailored to each region's level of financial development, industrial structure, and innovation infrastructure. Regions with a high concentration of financial and innovation resources should further promote the deep integration of tech finance with industrial and innovation chains. Regions with relatively weak financial foundations should not simply replicate the policy approaches of more developed regions; instead, they should prioritize the development of science and technology finance infrastructure by improving regional credit information platforms, technology achievement evaluation systems, and financing service systems for small and medium-sized enterprises (SMEs), thereby gradually enhancing the overall efficiency of policy transmission.

Fourth, financial support for technology-based manufacturing enterprises should be further strengthened to advance industrial transformation and upgrading. The industry heterogeneity analysis shows that the policy effect on long-term investment is statistically significant among manufacturing enterprises. Manufacturing enterprises generally require high capital investment, which corresponds to longer investment payback periods, making their need for stable, long-term financial support even more urgent. The government should guide financial institutions to align with the technological upgrading needs of advanced manufacturing, strategic emerging industries, and traditional manufacturing sectors, introducing a wider variety of financial products to support enterprises in upgrading equipment, improving processes, undergoing digital transformation, and implementing green and low-carbon upgrades. Furthermore, the government should encourage the inflow of long-term capital into the manufacturing sector to enhance the long-term investment capacity of manufacturing enterprises and advance industrial transformation and upgrading.

Fifth, it is necessary to improve the performance evaluation mechanism for science and technology finance policies to optimize their actual implementation outcomes. Whether science and technology finance policies can continue to be effective depends not only on the policy tools themselves but is also directly related to the sophistication of policy implementation and evaluation mechanisms. The government must establish a corresponding policy evaluation system, with core assessment indicators including corporate long-term investment, R&D expenditure, and innovation output, to avoid judging the actual effectiveness of policies solely based on financing scale or the number of loans. It is also necessary to strengthen oversight of how policy funds are utilized, guiding enterprises to effectively allocate the financial support they receive toward R&D, innovation, and long-term investment, thereby preventing the idle circulation of funds or deviations from policy objectives. Policies should be adjusted based on dynamic evaluation results and feedback to gradually enhance the precision and practical effectiveness of science and technology finance policies.

Moving forward, the science and technology finance policy framework must be continuously refined to enhance support for enterprises' long-term investments and R&D innovation, while implementing differentiated policy arrangements based on the nature of enterprise ownership, regional development conditions, and industry characteristics. Once these adjustments are fully implemented, science and technology finance will be better positioned to optimize corporate investment structures, promote industrial upgrading, and play a role in driving high-quality economic development.

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Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

Acknowledgment
This paper is an output of the science project.

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