# Research on the Impact of Fintech Integration Pilot Policies on Corporate Investment Efficiency

Xiujie Zhang *
South China University of Technology, Guangzhou 510006, China
* Corresponding Author Email: 27421132@qq.com

**Abstract.** With the deep integration of science and technology and finance, the pilot policy of combining science and technology and finance has become an important tool to promote enterprise innovation and investment efficiency. Based on the data of listed companies from 2007 to 2023, this paper discusses the influence of the pilot policy of combining technology and finance on the investment efficiency of enterprises and its mechanism. It is found that the policy significantly alleviates the problem of under-investment by improving the financing environment and reducing financing costs. However, policy did not curb overinvestment by reducing agency problems. Subsample analysis shows that the policy effect is particularly significant in state-owned enterprises and enterprises with low stock returns. Mechanism analysis further reveals that policies promote the improvement of enterprise investment efficiency by easing financing constraints. The research of this paper provides a theoretical basis for policy makers and a practical reference for enterprises to optimize investment decisions.

**Keywords:** Investment Efficiency, Financing Constraints, Science and Technology, Policy Impact, Under-Investment, Finance Integration.

## 1. Introduction

With the continuous improvement of China's economic strength and the improvement of its financial market system, the deep integration of scientific and technological innovation and financial services has become an important starting point for promoting high-quality economic development. In 2011, The State Council issued Several Opinions on Promoting the Combination of Science and Technology and Finance to Accelerate the Implementation of the Strategy of Independent Innovation for the first time. Subsequently, through institutional innovations such as credit risk compensation, intellectual property pledge financing, and science and technology insurance subsidies, a policy layout covering the eastern and western regions with gradient demonstration effect has been gradually formed. This policy aims to solve the dilemma of "difficult and expensive financing" faced by science and technology enterprises by optimizing the financial supply side structure, and provide strong support for economic transformation and upgrading. In recent years, state leaders have repeatedly stressed the importance of financial services to the real economy, and clearly proposed to improve the financial market system to ensure the stability of financial markets and control risks. However, the far-reaching impact of the technology and finance integration pilot policy on the investment efficiency of enterprises has not been fully discussed, and the research in this field has important practical significance and theoretical value.

In the academic field, many scholars have discussed the influence mechanism of the combination of technology and finance pilot policies on enterprise investment efficiency from different perspectives. According to the research of Yang Lixin [1] and Zhang Wenshan [2], technology finance policies have significantly improved the financing environment of enterprises through innovative financing models and venture capital support. However, there is still a lack of in-depth analysis of the internal mechanism of how the pilot policies of technology and finance combine to improve investment efficiency by affecting the financing environment of enterprises. Wang Hao [3] verified the key role of risk compensation mechanism in alleviating information asymmetry between banks and enterprises through the intermediary effect model. Chen Xiaohong et al. [4] pointed out that government guidance funds can leverage 4-6 times of social capital through signal transmission effect. Recent studies have extended to the micro-behavior level of enterprises. Liu Wei et al. [5] found that policies can restrain agency problems such as on-job consumption by management through strengthening external supervision. However, the existing studies have three significant limitations: First, the heterogeneity analysis of policy effects is mostly limited to the dimension of firm size, ignoring the interaction between property rights and market performance; Second, the "double-edged sword" effect of policy affecting investment efficiency (that is, simultaneously alleviating under-investment and intensifying over-investment) lacks mechanism deconstruction; Third, it fails to distinguish the differentiated effects of short-term liquidity support and long-term innovation incentives.

In this study, data of A-share listed companies from 2007 to 2023 was used, and the data came from CSMAR database. By building a regression model, this paper empirically tests the influence of the pilot policies of the combination of science and technology and finance on the investment efficiency of enterprises, focuses on the dual impact of the pilot policies of the combination of science and technology and finance on the investment efficiency of enterprises and its mechanism, and systematically examines the regulatory role of policies on under-investment and over-investment for the first time. The study found that the combination of technology and finance pilot policies significantly alleviated the problem of under-investment by improving the financing environment and reducing financing costs; However, policy did not curb overinvestment by reducing agency problems. The combination of technology and finance pilot policies has a significant positive impact on the investment efficiency of enterprises, and this result remains robust under different samples, different variable measurement methods and instrumental variable methods. Subsample analysis shows that the policy effect is particularly significant in state-owned enterprises and enterprises with low stock returns. Mechanism analysis further reveals that policies promote the improvement of enterprise investment efficiency by easing financing constraints. The research of this paper provides a theoretical basis for policy makers and a practical reference for enterprises to optimize investment decisions.

The contributions of this paper are mainly reflected in the following aspects: First, this paper adds the research literature on the impact of science and technology finance combined with pilot policies on enterprise investment efficiency, providing a theoretical basis for policy makers; Secondly, this paper reveals the internal mechanism of the combination of technology and finance pilot policies to affect the investment efficiency of enterprises, which is helpful to help enterprises optimize investment decisions. Finally, through empirical research, this paper verifies the positive impact of the technology and finance combined pilot policies on the investment efficiency of enterprises, and provides a useful reference for the formulation and implementation of relevant policies in the future.

The following chapters are arranged as follows: The second chapter reviews the relevant literature and puts forward the research hypothesis; The third chapter elaborates the research design, including variable measurement, model construction and data analysis methods. The fourth chapter reports the empirical research results, and carries on the robustness test and mechanism analysis; Chapter five discusses the research conclusions, policy implications and future research directions.

## 2. Literature Review

### 2.1. Research Review on the Integration of Technology and Finance Policies

The integration of technology and finance policies is an institutional innovation introduced by the Chinese government to address the financing difficulties of technology-based small and medium-sized enterprises (SMEs) and promote the implementation of the innovation-driven development strategy. In 2010, the People's Bank of China, together with the Ministry of Science and Technology, the China Banking Regulatory Commission, and four other departments, jointly issued the "Implementation Plan for Promoting the Integration of Technology and Finance Pilot Program," officially launching the pilot work on the integration of technology and finance. The first batch of pilot regions included 16 national high-tech zones, such as Zhongguancun in Beijing and Donghu in

Wuhan, aiming to build a technology finance service system characterized by "government guidance, market dominance, and multi-party participation" through policy coordination, product innovation, and mechanism breakthroughs. With the breakthrough progress made by the first batch of pilots in areas such as technology credit risk compensation and intellectual property pledge financing, the State Council further expanded the pilot scope to nine cities, including Zhengzhou and Ningbo, in 2016, forming a policy layout covering the eastern, central, and western regions with a gradient demonstration effect. The introduction of this policy coincided with a critical period of economic transformation and upgrading in China, aiming to address the financing difficulties and high costs faced by technology-based enterprises through financial supply-side structural reforms. The institutional design reflects the path of policy experimentation and gradual reform with Chinese characteristics.

Scholars' research on the integration of technology and finance policies mainly focuses on its economic effects and transmission mechanisms. Early studies mostly focused on the direct impact of policies on innovation output. For example, Yang Lixin [1] found that the pilot policy increased the number of patent applications by enterprises by 23%, and Zhang Wenshan [2] estimated that the policy reduced the debt financing costs of technology-based enterprises by about 1.2 percentage points. As research deepened, scholars began to explore the boundaries and transmission paths of the policy: Wang Hao [3] verified the key role of the risk compensation mechanism in alleviating information asymmetry between banks and enterprises through a mediation effect model; Chen Xiaohong et al. [4] pointed out that government-guided funds could leverage 4-6 times social capital through the signal transmission effect. Recent research has extended to the micro-level behavior of enterprises. Liu Wei et al. [5] found that the policy could suppress agency problems such as management consumption through strengthening external supervision. However, existing research has three significant limitations: first, the heterogeneity analysis of policy effects is mostly limited to the dimension of enterprise size, ignoring the interaction between ownership nature and market performance; second, there is a lack of mechanism deconstruction of the "double-edged sword" effect of the policy on investment efficiency (i.e., simultaneously alleviating underinvestment and exacerbating overinvestment); third, there is a failure to effectively distinguish the differential impacts of short-term liquidity support and long-term innovation incentives.

## 2.2. Research Review on Enterprise Investment Efficiency

Enterprise investment efficiency essentially reflects the effectiveness of capital allocation, referring to the degree of deviation between the actual investment level and the optimal investment scale of an enterprise [6]. Neoclassical investment theory holds that under the assumption of a perfect market, enterprise investment decisions should satisfy the optimal condition of marginal revenue equal to marginal cost [7]. However, in reality, due to financing constraints, agency conflicts, and information asymmetry, enterprises generally suffer from underinvestment or overinvestment, both of which lead to investment efficiency losses [8].

Existing literature explores the influencing factors of investment efficiency from multiple dimensions. The financing constraint perspective emphasizes that external financing cost premiums can cause enterprises to abandon projects with positive net present value [9]. Lian Yujun [10] found that underinvestment caused by financing constraints in Chinese listed companies accounted for about 17% of capital expenditures. Agency theory focuses on the opportunistic behavior of management. Jensen's [11] free cash flow hypothesis points out that managers may engage in overinvestment to pursue personal gains. Zhang Huili [12] estimated that the efficiency loss caused by overinvestment in Chinese listed companies exceeded 8 billion yuan annually. Institutional environmental factors are also important. Luo Danglun [13] found that a one-standard-deviation increase in regional financial development levels could improve enterprise investment efficiency by 0.13 standard deviations. In recent years, research has further extended to emerging influencing factors such as digital transformation [14] and supply chain relationships [15]. Recent research has further expanded the theoretical framework in this field. Wang Hao [3] verified the key role of the risk compensation mechanism in alleviating information asymmetry between banks and enterprises through a mediation effect model, emphasizing the important role of policies in improving the financing environment of enterprises. Chen Xiaohong et al. [4] pointed out that government-guided funds could leverage 4-6 times social capital through the signal transmission effect, revealing the important mechanism of policies in promoting financial market liquidity. Liu Wei et al. [5] found that policies could suppress agency problems such as management consumption through strengthening external supervision, providing a new perspective for understanding the impact of policies on corporate governance structures. These studies not only enrich the understanding of policy transmission mechanisms but also provide a theoretical basis for this paper.

Although existing research has conducted in-depth discussions on the influencing mechanisms of investment efficiency, literature focusing on the impact of policy shocks is still insufficient. Especially for institutional innovations such as the technology-finance integration pilot, which combines financial supply-side reform and industrial policy characteristics, how it regulates enterprise investment behavior by reconstructing the financing environment, may both alleviate underinvestment by easing financing constraints and induce overinvestment due to the convenience of resource acquisition. This complexity of policy effects has not been fully revealed. The breakthrough of this paper lies in systematically examining the dual impact of the technology-finance integration pilot policy on enterprise investment efficiency and its boundary effects, providing a new theoretical perspective for understanding the dynamic adjustment of enterprise investment decisions under policy intervention.

### 2.3. Research Hypotheses

The technology-finance integration pilot policy can significantly alleviate the financing constraints faced by enterprises by innovating financing tools and optimizing resource allocation. First, government-guided funds and risk compensation mechanisms directly broaden the financing channels for technology-based enterprises, especially providing alternative financing support for light-asset, high-risk innovative enterprises outside the traditional credit system [1,4]. Second, the policy reduces the risk perception of financial institutions by lowering information asymmetry between banks and enterprises, thereby reducing debt financing costs [2,3]. In addition, the construction of a multi-level capital market further enhances the availability of equity financing, especially the institutional design of the Science and Technology Innovation Board, which provides a dedicated channel for technology-based enterprises to go public [16]. According to the financing constraint theory [9], when external financing costs are higher than internal capital costs, enterprises will be forced to abandon investment projects with positive net present value due to capital shortages, leading to underinvestment. The technology-finance policy reduces external financing costs and expands financing scale through the above mechanisms, enabling enterprises to break through liquidity constraints and allocate funds to high-return innovation activities, thereby effectively improving underinvestment problems.

Fintech-integrated pilot policies may also mitigate agency issues by enhancing information transparency and strengthening external oversight, thereby discouraging overinvestment. On the one hand, the policy requires enterprises to disclose more information about technological innovation and capital use, which enhances operational transparency and enables investors to identify opportunistic behaviors of management more effectively [3]. On the other hand, the government guides the participation of funds and the involvement of venture capital institutions, and strengthens the constraints on management through board governance and contract clause design [5]. According to agency theory [11], when free cash flow is abundant and supervision is absent, management may invest funds in "empire building" projects with negative net present value for private gain. By introducing the supervisory functions of professional institutional investors (such as post-investment management requirements of government-guided funds) and market-oriented restraint mechanisms (such as information disclosure rules of the science and technology board), technology finance policies can reduce the abuse of free cash flow by management, thereby curbing excessive investment.

In summary, this paper argues that the technology-finance integration pilot policy can significantly alleviate the financing constraints faced by enterprises by innovating financing tools and optimizing resource allocation. Accordingly, we propose the research hypothesis H1:

H1: The technology-finance integration pilot policy significantly improves enterprise investment efficiency by alleviating financing constraints and agency problems.

Although the technology-finance policy improves the financing environment, its supervision effectiveness on capital flows may be insufficient, potentially exacerbating overinvestment. First, the policy lowers the credit threshold for financial institutions through the risk compensation mechanism, which may lead some enterprises to obtain low-cost funds under the name of "technology" and then divert them to non-innovation fields (such as real estate speculation or financial arbitrage). Second, state-owned enterprises and low-return enterprises are more likely to use new funds for capacity expansion or inefficient mergers and acquisitions rather than core technology R&D due to soft budget constraints [17] and governance defects [5]. In addition, the policy's short-term performance assessment orientation may induce strategic innovation behavior by enterprises, that is, obtaining subsidies by "packaging" R&D projects while actual funds still flow to traditional businesses [1]. This "resource curse" effect is particularly prominent in enterprises with eased financing constraints but weak governance mechanisms, ultimately leading to the worsening of overinvestment problems.

In summary, this paper argues that although the technology-finance policy has significant effects in improving the financing environment, its supervision effectiveness on capital flows may be insufficient, potentially exacerbating overinvestment. Accordingly, we propose the research hypothesis H2:

H2: The technology-finance integration pilot policy may exacerbate agency problems and reduce enterprise investment efficiency due to ineffective supervision of fund usage.

### 2.4. Regression Model Specification

To examine the impact of the technology-finance integration pilot policy on enterprise investment efficiency, referring to the policy evaluation methods of Lan Fei et al. and Tan Changchun et al. the following regression model is constructed:

$$absInvi,\ t=\alpha+\beta\ (Treati,\ t*Posti,\ t)\ +\gamma Controli,\ t+\sum Year+\sum Firm+\varepsilon i,\ t. \quad (1)$$

The absolute investment efficiency (absInv) in Table 1 is the core explained variable of this paper. Referring to the methods of Richardson [6] and Wu Xiaoguang [18], the absolute deviation between the actual investment level and the optimal investment level is used to measure investment efficiency. Specifically, the smaller the absolute value of the difference between the actual investment level and the optimal investment level, the higher the investment efficiency of the enterprise. In the existing literature, the measurement method of absolute investment efficiency has high operability and explanatory power. To further analyze the heterogeneity of investment efficiency, this paper defines the sample with actual investment higher than the optimal value as overinvestment (OInv) and the sample with actual investment lower than the optimal value as underinvestment (UInv), and constructs dummy variables for heterogeneity testing.

Treat×Post is the core explanatory variable of the technology-finance integration pilot policy. Referring to the two batches of implementation times of China's technology-finance integration pilot policy (such as the 2011 and 2016 pilot lists), a dummy variable (Treat×Post) is used as a proxy variable for policy implementation. Specifically, if the enterprise is located in a region included in the policy scope during the pilot year, the variable takes the value of 1; otherwise, it takes the value of 0. The research focus of this paper is the significance test of the coefficient β in the regression model. If the coefficient β is significantly greater than zero, it can be inferred that the technology-finance integration pilot policy has a positive promoting effect on enterprise investment efficiency, thereby supporting the research hypothesis of this paper.

Control is a series of control variables, including enterprise size (Size), financial leverage (Leverage), profitability (ROA), growth (Growth), cash flow level (Cash), institutional shareholding

(InstHold), enterprise age (Age), governance structure (Boardsize), and market valuation (TobinQ). Year, Industry, and Area respectively indicate that this paper controls for year, industry, and region fixed effects to eliminate the impact of time trends, industry heterogeneity, and regional differences. To control potential cross-sectional correlation problems, this paper clusters the standard errors at the enterprise level in all regressions.

**Table 1.** Variable Definitions and Construction

| Variable Symbol | Variable Name | Variable Construction Description |
|---|---|---|
| absInv | Inefficient Investment | Absolute value of the difference between actual investment level and optimal investment level |
| OInv | Overinvestment | Deviation of enterprise investment level relative to its capital return rate |
| UInv | Underinvestment | Difference between actual investment and expected investment |
| Treat_Post | Dummy Variable | If the enterprise is located in the pilot region during the technology-finance policy pilot year, the variable takes the value of 1; otherwise, it takes the value of 0 |
| Size | Total Assets | Natural logarithm of total assets |
| Leverage | Asset-Liability Ratio | Ratio of total liabilities to total assets |
| ROA | Return on Assets | (Net profit + interest expense + income tax) / average total assets * 100% |
| Growth | Operating Income Growth Rate | (Current year operating income - previous year operating income) / previous year operating income |
| Cash | Operating Cash Flow | Net profit + non-cash expenses ± working capital changes |
| InstHold | Institutional Shareholding Ratio | Total shares held by institutions / total company shares * 100% |
| Age | Enterprise Age | Proxy variable for enterprise life cycle |
| Boardsize | Board Size | Natural logarithm of the number of board members |
| TobinQ | Tobin's Q | Ratio of market value of enterprise investment to replacement cost |

# 3. Empirical Design

## 3.1. Data Source

The research sample consists of A-share listed companies in China from 2007 to 2023, and their financial data are sourced from the CSMAR database. In the screening process, this paper mainly follows the following steps: ① Exclude special sample groups, specifically excluding companies in the financial and real estate industries, as well as companies under special treatment (ST), special transfer (PT), or during the initial public offering (IPO) period. ② Exclude company samples with missing data and perform a 1% bilateral tailing adjustment on the data to reduce the potential interference of outliers on the analysis results. It is specifically pointed out that the technology and finance integration policy pilot regions in this paper include the regions that implemented the technology and finance integration policy in 2011 and 2016. For research needs, this paper refines the first batch of 16 pilot regions into 41 prefecture-level cities and adds 9 pilot cities in 2016. The remaining non-pilot cities are set as the control group for comparative analysis.

## 3.2. Descriptive Statistics

Table 2 shows the descriptive statistical results of the main variables in this study. From the table, it can be seen that the mean value of enterprise investment efficiency (absInv) is 3.956, and the standard deviation is 4.762, indicating that there are significant differences in investment efficiency among different enterprises. The mean values of overinvestment (OInv) and underinvestment (UInv) are 4.802 and -3.389, respectively, with standard deviations of 6.370 and 3.537, further indicating significant heterogeneity in enterprise investment behavior. The mean value of the technology-finance integration pilot policy (Treat) is 0.600, indicating that about 60% of the enterprises in the sample are affected by the policy. The mean value of post-policy implementation (Post) is 0.520, indicating that about 52% of the observations are in the post-policy implementation period.

In terms of control variables, the mean value of enterprise size (Size) is 22.32, and the standard deviation is 1.294, indicating that the size distribution of sample enterprises is relatively concentrated but still has certain differences. The mean value of the asset-liability ratio (Leverage) is 0.443, and the standard deviation is 0.200, indicating that the debt levels of enterprises have certain fluctuations. The mean value of return on assets (ROA) is 0.0327, and the standard deviation is 0.0621, indicating significant differences in the profitability of enterprises. In addition, the mean values and standard deviations of enterprise growth (Growth), cash holding level (Cash), institutional shareholding ratio (InstHold), enterprise age (Age), board size (Boardsize), and Tobin's Q (TobinQ) also reflect the diversity of sample enterprises in terms of financial structure, governance characteristics, and market valuation.

**Table 2.** Descriptive Statistics

| VARIABLES | N | mean | sd | min |
|---|---|---|---|---|
| absInv | 37,444 | 3.956 | 4.762 | 0.0422 |
| OInv | 15,787 | 4.802 | 6.370 | 0.0333 |
| UInv | 21,646 | -3.389 | 3.537 | -20.95 |
| Treat | 37,444 | 0.600 | 0.490 | 0 |
| Post | 37,444 | 0.520 | 0.500 | 0 |
| Size | 37,444 | 22.32 | 1.294 | 19.95 |
| Leverage | 37,444 | 0.443 | 0.200 | 0.0630 |
| ROA | 37,444 | 0.0327 | 0.0621 | -0.240 |
| Growth | 37,444 | 0.146 | 0.363 | -0.558 |
| Cash | 37,444 | 0.152 | 0.112 | 0.0102 |
| InstHold | 37,444 | 6.979 | 7.898 | 0 |
| Age | 37,444 | 2.934 | 0.330 | 1.946 |
| Boardsize | 37,444 | 2.130 | 0.201 | 1.609 |
| TobinQ | 37,444 | 2.013 | 1.253 | 0.832 |

# 4. Empirical Results and Analysis

## 4.1. Baseline Regression Results Analysis

**Table 3.** Baseline Regression Results

| VARIABLES | N | mean | sd |
|---|---|---|---|
| TreatPost | -0.414*** | 0.350 | 0.820*** |
| | (-2.596) | (1.167) | (5.726) |
| Size | 0.217** | 0.328* | -0.095 |
| | (2.436) | (1.796) | (-1.178) |
| Leverage | 0.805** | 1.107 | -0.254 |
| | (2.270) | (1.459) | (-0.757) |
| ROA | 3.565*** | 3.776** | -2.456*** |
| | (5.393) | (2.485) | (-3.662) |
| Growth | 1.343*** | 2.873*** | -0.275*** |
| | (12.336) | (12.488) | (-2.793) |
| Cash | 0.415 | -1.302 | -0.859** |
| | (1.011) | (-1.539) | (-2.065) |
| InstHold | 0.023*** | 0.058*** | 0.006 |
| | (4.176) | (5.302) | (1.122) |
| Age | -2.636*** | -3.379*** | 1.716*** |
| | (-5.099) | (-3.240) | (3.802) |
| Boardsize | -0.121 | -0.276 | -0.035 |
| | (-0.445) | (-0.470) | (-0.141) |
| TobinQ | 0.363*** | -0.117 | -0.519*** |
| | (8.161) | (-1.285) | (-11.573) |
| Constant | 5.114** | 6.847 | -4.658** |
| | (2.307) | (1.545) | (-2.388) |
| Observations | 37,444 | 15,787 | 21,646 |
| R-squared | 0.103 | 0.098 | 0.143 |
| Firm FE | YES | YES | YES |
| Year FE | YES | YES | YES |

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

The baseline regression results in Table 3 show that the impact of the technology-finance integration pilot policy (Treat_Post) on enterprise investment efficiency exhibits significant differentiation characteristics. From the perspective of overall investment efficiency (absInv), the coefficient of the policy variable is 0.414 and significant at the 1% level, indicating that the absolute investment efficiency of enterprises decreases after the implementation of the policy, reflecting the deterioration of capital use efficiency. This may stem from the lack of scientific investment planning by enterprises after obtaining relaxed financing, leading to improper resource allocation. The sub-item test shows that the impact coefficient of the policy on overinvestment (OInv) is 0.350 but does not pass the significance test, indicating that the policy does not systematically exacerbate the overinvestment behavior of enterprises. Combined with the findings of this paper, the technology-finance integration pilot policy significantly alleviates the underinvestment problem by improving the financing environment and reducing financing costs for enterprises. Therefore, the baseline regression results need to be understood in context: the negative impact of the policy on absInv may reflect the transformation of enterprise investment behavior before and after the implementation of the policy, rather than a simple decline in investment efficiency. Specifically, the policy enables enterprises to increase investment by alleviating financing constraints, but as the policy fails to effectively suppress overinvestment, some enterprises may use new funds for inefficient or non-innovation projects, leading to a decline in overall investment efficiency. Therefore, the baseline regression results and the actual role of the policy need to be comprehensively understood in combination with the sub-sample analysis results (the policy effect is particularly significant in state-owned enterprises and enterprises with low stock returns) and the mechanism analysis results (the policy promotes the improvement of enterprise investment efficiency by alleviating financing constraints). These results comprehensively indicate that although the technology-finance integration pilot policy broadens financing channels, it fails to ensure the precise allocation of funds to high-return projects through effective supervision mechanisms, and instead exacerbates the loss of enterprise investment efficiency due to resource misallocation. Ultimately, the baseline regression results support the argument of hypothesis H2, that is, the policy leads to a decline in enterprise investment efficiency due to insufficient supervision effectiveness.

### 4.2. Robustness Tes

#### 4.2.1. Replacing the Explained Variable

**Table 4.** Replacing the Explained Variable

| VARIABLES | N | mean | sd |
|---|---|---|---|
| Treat_Post | -0.386** | 0.465 | 0.823*** |
| | (-2.038) | (1.277) | (4.988) |
| Size | 0.263*** | 0.382* | -0.128 |
| | (2.577) | (1.759) | (-1.389) |
| Leverage | 1.147*** | 1.490 | -0.350 |
| | (2.713) | (1.622) | (-0.893) |
| ROA | 4.350*** | 3.387* | -3.273*** |
| | (5.384) | (1.728) | (-4.221) |
| Growth | 1.640*** | 3.406*** | -0.367*** |
| | (12.275) | (12.181) | (-3.225) |
| Cash | 0.463 | -1.738* | -1.030** |
| | (0.952) | (-1.711) | (-2.151) |
| InstHold_JFX | 0.024*** | 0.057*** | 0.006 |
| | (3.793) | (4.512) | (0.925) |
| Age | -2.517*** | -3.140** | 1.626*** |
| | (-4.156) | (-2.455) | (3.148) |
| Boardsize | 0.047 | 0.230 | -0.118 |
| | (0.143) | (0.317) | (-0.417) |
| TobinQ | 0.368*** | -0.072 | -0.516*** |
| | (7.205) | (-0.683) | (-10.169) |
| Constant | 4.031 | 4.997 | -3.991* |
| | (1.608) | (0.957) | (-1.840) |
| Observations | 30,523 | 12,653 | 17,859 |
| R-squared | 0.122 | 0.115 | 0.178 |
| Number of stkcd | 4,394 | 3,696 | 4,017 |
| Firm FE | YES | YES | YES |
| Year FE | YES | YES | YES |

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

To further verify the robustness of the research results, this paper refers to the suggestions of Chen Yunsen and Xie Deren [19] and adjusts the explained variable. Specifically, this paper deletes samples with values close to 0 in the explained variable to avoid the potential impact of extreme values on the regression results. After deleting these samples, this paper reconstructs a new explained variable and conducts regression analysis. Table 4 shows the regression results after replacing the explained variable. Compared with the baseline regression results, the impact of the technology-finance integration pilot policy (Treat_Post) on enterprise investment efficiency still presents significant differentiation characteristics. Specifically, the coefficient of the policy variable on overall investment efficiency (absInv2) is -0.386 and significant at the 5% level, indicating that enterprise investment efficiency decreases after the implementation of the policy. This result is consistent with the baseline regression results, further supporting the conclusion that the policy may lead to a decline in investment efficiency due to resource misallocation. In terms of overinvestment (OInv2), the coefficient of the policy variable is 0.465 but does not pass the significance test, indicating that the policy does not significantly exacerbate the overinvestment behavior of enterprises. In terms of underinvestment (UInv2), the coefficient of the policy variable is 0.823 and significant at the 1% level, indicating that the policy significantly improves the underinvestment problem of enterprises by alleviating financing constraints. The regression results of the control variables are basically consistent with the baseline regression results, indicating that the model setting of this paper has good robustness. In summary, the regression results after replacing the explained variable further verify the research hypothesis of this paper, that is, the technology-finance integration pilot policy significantly improves the underinvestment problem of enterprises by alleviating financing constraints, but may lead to resource misallocation due to insufficient supervision effectiveness, thereby reducing overall investment efficiency. This result provides an important reference for policymakers, suggesting that when implementing technology-finance policies, the supervision and management of fund usage should be strengthened to ensure that funds can be accurately allocated to high-return innovation projects.

### 4.2.2. Parallel Trend Test

**Table 5.** Parallel Trend Test

| VARIABLES | N | mean | sd |
|---|---|---|---|
| Treat_Before3 | -0.131 | -0.271 | -0.343 |
| | (-0.443) | (-0.435) | (-1.225) |
| Treat_Before2 | -0.381 | -0.201 | 0.386 |
| | (-1.201) | (-0.286) | (1.402) |
| Treat_Before1 | 0.041 | 0.237 | -0.163 |
| | (0.126) | (0.357) | (-0.544) |
| Treat_Current | -0.946*** | -0.507 | 1.002*** |
| | (-3.002) | (-0.829) | (3.308) |
| Treat_After1 | -0.817*** | -0.110 | 1.003*** |
| | (-3.106) | (-0.211) | (4.223) |
| Treat_After2 | -0.728*** | 0.084 | 1.079*** |
| | (-2.673) | (0.160) | (4.264) |
| Treat_After3+ | -0.357 | 0.572 | 0.693*** |
| | (-1.433) | (1.301) | (3.200) |
| Size | 0.212** | 0.318* | -0.090 |
| | (2.385) | (1.748) | (-1.119) |
| Leverage | 0.798** | 1.096 | -0.247 |
| | (2.250) | (1.447) | (-0.734) |
| ROA | 3.586*** | 3.744** | -2.477*** |
| | (5.425) | (2.466) | (-3.691) |
| Growth | 1.342*** | 2.869*** | -0.276*** |
| | (12.310) | (12.469) | (-2.803) |
| Cash | 0.467 | -1.234 | -0.905** |
| | (1.130) | (-1.451) | (-2.170) |
| InstHold_JFX | 0.023*** | 0.058*** | 0.006 |
| | (4.188) | (5.302) | (1.133) |
| Age | -2.602*** | -3.290*** | 1.714*** |
| | (-5.029) | (-3.147) | (3.796) |
| Boardsize | -0.122 | -0.263 | -0.032 |
| | (-0.451) | (-0.449) | (-0.131) |
| TobinQ | 0.362*** | -0.120 | -0.517*** |
| | (8.108) | (-1.310) | (-11.534) |
| Constant | 5.135** | 6.813 | -4.753** |
| | (2.314) | (1.538) | (-2.432) |
| Observations | 37,444 | 15,787 | 21,646 |
| R-squared | 0.103 | 0.099 | 0.143 |
| Number of stkcd | 4,480 | 3,855 | 4,124 |
| Firm FE | YES | YES | YES |
| Year FE | YES | YES | YES |

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

In Table 5, Absolute investment efficiency (absInv): The coefficients of 3 years before policy implementation (Treat_Before3), 2 years before (Treat_Before2), and 1 year before (Treat_Before1) are 0.131, 0.381, and 0.041, respectively, and the t-statistics do not pass the significance test (p>0.1), indicating that there is no significant difference in the investment efficiency trend between the treatment group and the control group before the implementation of the policy, satisfying the parallel trend assumption. The coefficients of the year of policy implementation (Treat_Current) and the subsequent 12 years (Treat_After1, Treat_After2) are 0.946, 0.817, and 0.728, respectively, all significantly negative at the 1% level, indicating that the policy significantly reduces the degree of deviation of enterprise investment from the optimal level and improves investment efficiency. The effect of the policy 3 years and above (Treat_After3+) is weakened (coefficient 0.357, p>0.1), indicating that the policy effect presents short-term strengthening characteristics. Overinvestment (OInv): The coefficients of all time points before and after policy implementation do not pass the significance test (e.g., the coefficient of Treat_Current is 0.507, p>0.1), indicating that the impact of the technology-finance integration pilot policy on alleviating enterprise overinvestment behavior is limited, possibly due to the failure of policy resources to accurately constrain the capital allocation of high-risk projects. Underinvestment (UInv): The coefficients of all periods before policy implementation are not significant (e.g., the coefficient of Treat_Before1 is 0.163, p>0.1), again verifying the parallel trend assumption. The effect after policy implementation is significantly enhanced: The coefficients of Treat_Current, Treat_After1, Treat_After2, and Treat_After3+ are 1.002, 1.003, 1.079, and 0.693, respectively, all passing the 1% significance test and positive. Combined with the model setting (UInv=1 indicates that actual investment is lower than the optimal level), the positive coefficient indicates that the policy significantly reduces the probability of enterprise underinvestment, verifying the core mechanism of "alleviating financing constraints" in H1. The parallel trend test shows that there is no systematic difference in the investment efficiency trend between the treatment group and the control group before the implementation of the policy, the policy effect gradually appears after implementation, and the improvement effect on underinvestment is persistent, and the DID model setting is reasonable. This result provides robustness support for subsequent mechanism analysis.

### 4.2.3. Endogeneity Test

**Table 6.** PSM-DID Results

| VARIABLES | N | mean | sd |
|---|---|---|---|
| Treat_Post | -0.366** | 0.388 | 0.794*** |
| | (-2.074) | (1.158) | (4.713) |
| Size | 0.199* | 0.344 | -0.078 |
| | (1.917) | (1.511) | (-0.832) |
| Leverage | 1.108*** | 1.565* | -0.293 |
| | (2.749) | (1.791) | (-0.767) |
| ROA | 4.178*** | 4.980*** | -2.608*** |
| | (5.637) | (2.949) | (-3.390) |
| Growth | 1.308*** | 2.748*** | -0.320*** |
| | (10.312) | (10.183) | (-2.738) |
| Cash | 0.300 | -1.720 | -0.473 |
| | (0.552) | (-1.507) | (-0.873) |
| InstHold_JFX | 0.030*** | 0.062*** | 0.002 |
| | (4.787) | (4.874) | (0.269) |
| Age | -3.048*** | -4.351*** | 1.909*** |
| | (-4.910) | (-3.364) | (3.513) |
| Boardsize | -0.121 | -0.035 | -0.029 |
| | (-0.370) | (-0.052) | (-0.093) |
| TobinQ | 0.313*** | -0.200* | -0.503*** |
| | (5.928) | (-1.749) | (-9.243) |
| Constant | 6.493** | 8.454 | -5.498** |
| | (2.514) | (1.547) | (-2.416) |
| Observations | 29,294 | 12,305 | 16,983 |
| R-squared | 0.092 | 0.091 | 0.127 |
| Number of stkcd | 4,184 | 3,499 | 3,774 |
| Firm FE | YES | YES | YES |
| Year FE | YES | YES | YES |

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

To further verify the robustness of our research conclusions, we used the Propensity Score Matching (PSM) method for robustness testing. Through this method, we were able to match individuals with similar characteristics in the treatment group and the control group, simulating the conditions of a randomized controlled trial and controlling for potential selection bias. After propensity score matching, we used the Difference-in-Differences (DID) method for regression analysis. Table 6 lists the regression results after matching, still indicating that the technology-finance integration pilot policy has a significant impact on enterprise investment efficiency. First, in the regression results, the regression coefficient of Treat_Post (the interaction variable of the technology-finance integration pilot policy) on absolute investment efficiency (absInv) is 0.366 and has a significant negative impact (t-value=2.074), indicating that the policy significantly reduces enterprise investment efficiency. For overinvestment (OInv), the regression results did not find a significant impact (regression coefficient is 0.388, t-value is 1.158), indicating that the policy's impact on overinvestment is not significant. However, in terms of underinvestment (UInv), the regression results show that Treat_Post has a significant and positive impact on underinvestment (regression coefficient is 0.794, t-value is 4.713, p<0.01), indicating that the technology-finance integration pilot policy significantly increases the underinvestment phenomenon of enterprises. Overall, the PSM-DID results are consistent with the baseline regression results and indicate that the technology-finance integration pilot policy has a significant negative impact on enterprise investment efficiency, especially in terms of suppressing overinvestment and enhancing underinvestment, with strong statistical significance.

# 5. Further Analysis

## 5.1. Heterogeneity Analysis

### 5.1.1. Heterogeneity Analysis Based on Stock Returns

**Table 7.** Heterogeneity Analysis Based on Stock Returns

| VARIABLES | absInv (Return < 0) | absInv (Return > 0) | OInv | OInv | UInv |
|---|---|---|---|---|---|
| Treat_Post | -0.717*** | -0.125 | -0.229 | 0.723 | 0.937*** |
| | (-3.498) | (-0.571) | (-0.490) | (1.635) | (4.638) |
| Size | 0.355*** | 0.149 | 0.309 | 0.368 | -0.291** |
| | (3.031) | (1.192) | (1.358) | (1.262) | (-2.440) |
| Leverage | 0.673 | 1.048* | 1.085 | 1.628 | -0.008 |
| | (1.436) | (1.955) | (1.068) | (1.320) | (-0.015) |
| ROA | 3.157*** | 5.059*** | 3.916** | 3.976 | -2.281** |
| | (3.657) | (4.271) | (2.010) | (1.521) | (-2.451) |
| Growth | 1.014*** | 1.659*** | 2.098*** | 3.174*** | -0.243* |
| | (6.976) | (9.799) | (6.189) | (8.991) | (-1.681) |
| Cash | 0.473 | 0.448 | -0.346 | -1.891 | -0.785 |
| | (0.827) | (0.740) | (-0.250) | (-1.417) | (-1.335) |
| InstHold_JFX | 0.020** | 0.026*** | 0.052*** | 0.061*** | 0.002 |
| | (2.362) | (3.634) | (2.744) | (3.959) | (0.182) |
| Age | -2.230*** | -3.226*** | -1.646 | -5.246*** | 2.023*** |
| | (-3.240) | (-4.407) | (-1.107) | (-3.309) | (2.985) |
| Boardsize | -0.178 | 0.146 | -0.157 | -0.356 | -0.015 |
| | (-0.539) | (0.341) | (-0.216) | (-0.362) | (-0.044) |
| TobinQ | 0.748*** | 0.236*** | 0.052 | -0.166 | -0.972*** |
| | (9.210) | (4.121) | (0.283) | (-1.248) | (-10.839) |
| Constant | 0.623 | 7.315** | 1.671 | 10.808 | -0.682 |
| | (0.212) | (2.404) | (0.279) | (1.559) | (-0.236) |
| Observations | 19,045 | 18,399 | 7,539 | 8,248 | 11,495 |
| R-squared | 0.106 | 0.111 | 0.072 | 0.121 | 0.170 |
| Number of stkcd | 4,097 | 4,106 | 3,134 | 3,287 | 3,685 |
| Firm FE | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES |

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

Enterprises with low stock returns usually face more severe financing constraints, which makes the technology-finance integration pilot policy have a more significant effect on alleviating the underinvestment problem of these enterprises. The policy helps enterprises overcome financing difficulties by optimizing financing channels, reducing financing costs, and providing government guarantees, thereby improving investment efficiency. Especially in enterprises with low stock returns, financing constraints are more prominent, so the policy's improvement effect on their underinvestment is more obvious, promoting enterprise investment decisions and resource allocation efficiency. The regression results in the Table 7 show that the impact of the technology-finance integration pilot policy on enterprise investment efficiency shows significant differences among enterprises with different stock return levels. Specifically, the policy has the most significant impact on enterprises with stock returns less than 0 (underinvestment group), with a regression coefficient of 0.937, indicating that the policy significantly improves the investment efficiency of these enterprises by alleviating financing constraints. In contrast, the net effect of the policy on enterprises with stock returns greater than 0 (overinvestment group) is smaller, with a regression coefficient of 0.723, indicating that the policy's effect on improving the investment efficiency of these enterprises is relatively limited. Overall, the policy's role in improving the financing environment of enterprises is more prominent in enterprises with low stock returns.

### 5.1.2. Heterogeneity Analysis Based on Enterprise Nature

**Table 8.** Heterogeneity Analysis Based on Enterprise Nature

| VARIABLES | absInv | absInv | OInv | OInv | UInv |
|---|---|---|---|---|---|
| Treat_Post | -0.554** | -0.172 | 0.366 | 0.349 | 0.810*** |
| | (-2.108) | (-0.857) | (0.725) | (0.907) | (3.482) |
| Size | 0.373*** | -0.053 | 0.801*** | -0.282 | -0.130 |
| | (2.817) | (-0.431) | (2.749) | (-1.299) | (-1.116) |
| Leverage | 1.447*** | 0.527 | 2.008* | 0.721 | -0.719 |
| | (2.845) | (1.034) | (1.777) | (0.709) | (-1.502) |
| ROA | 3.201*** | 3.807*** | 3.072 | 3.380 | -2.187*** |
| | (3.970) | (3.334) | (1.501) | (1.560) | (-2.675) |
| Growth | 1.586*** | 0.777*** | 3.376*** | 1.676*** | -0.270** |
| | (10.302) | (5.606) | (10.529) | (5.336) | (-1.993) |
| Cash | 0.732 | 0.343 | -1.830 | -0.615 | -1.327** |
| | (1.393) | (0.482) | (-1.587) | (-0.489) | (-2.513) |
| InstHold_JFX | 0.015** | 0.028*** | 0.044*** | 0.066*** | 0.010 |
| | (2.129) | (3.148) | (2.920) | (3.981) | (1.389) |
| Age | -3.059*** | -1.732** | -4.407*** | -1.101 | 2.570*** |
| | (-4.286) | (-2.075) | (-2.903) | (-0.657) | (4.003) |
| Boardsize | 0.260 | -0.510 | -0.375 | -0.004 | -0.489 |
| | (0.710) | (-1.237) | (-0.448) | (-0.005) | (-1.420) |
| TobinQ | 0.329*** | 0.422*** | -0.147 | -0.081 | -0.512*** |
| | (5.901) | (5.352) | (-1.222) | (-0.575) | (-9.364) |
| Constant | 2.038 | 9.439*** | 0.257 | 13.255** | -4.578* |
| | (0.664) | (2.688) | (0.040) | (1.978) | (-1.723) |
| Observations | 23,005 | 14,439 | 9,511 | 6,276 | 13,487 |
| R-squared | 0.105 | 0.099 | 0.119 | 0.074 | 0.133 |
| Number of stkcd | 3,484 | 1,371 | 2,906 | 1,198 | 3,132 |
| Firm FE | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES |

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

Based on the nature and environment of enterprises, some enterprises may have significant differences in their response to policies and policy effects due to financing constraints. For example, state-owned enterprises and enterprises with low stock returns are more likely to be affected by financing constraints due to soft budget constraints, governance defects, or other factors, so the technology-finance integration pilot policy has a more significant effect on alleviating the underinvestment problem of these enterprises. This difference reflects the policy's effect in improving the financing environment and reducing financing costs of enterprises, and shows different influences in different types of enterprises. The regression results in the Table 8 show that the impact of the technology-finance integration pilot policy on enterprise investment efficiency has significant robustness under different samples and variable measurement methods. Sub-sample analysis shows that the policy effect is particularly significant in state-owned enterprises and enterprises with low stock returns, which is closely related to the financing constraints and governance characteristics of enterprises. Mechanism analysis further reveals that the policy promotes the improvement of enterprise investment efficiency by alleviating financing constraints, but in some enterprises, due to insufficient supervision effectiveness, it may lead to resource misallocation, thereby reducing overall investment efficiency. These results provide an important reference for policymakers, suggesting that when implementing technology-finance policies, the supervision and management of fund usage should be strengthened to ensure that funds can be accurately allocated to high-return innovation projects.

### 5.2. Mechanism Analysis

**Table 9.** Mechanism Analysis Results

| VARIABLES | Tunnel | KZIndex |
|---|---|---|
| Treat_Post | 0.000 | -0.196*** |
| | (0.252) | (-5.574) |
| Size | -0.001** | -0.205*** |
| | (-2.077) | (-9.745) |
| Leverage | 0.010*** | 5.141*** |
| | (4.831) | (60.350) |
| ROA | -0.022*** | -6.643*** |
| | (-5.919) | (-33.108) |
| Growth | -0.002*** | -0.248*** |
| | (-3.957) | (-11.243) |
| Cash | -0.008*** | -6.030*** |
| | (-3.737) | (-56.091) |
| InstHold_JFX | -0.000* | -0.000 |
| | (-1.713) | (-0.052) |
| Age | 0.008** | 0.038 |
| | (2.292) | (0.293) |
| Boardsize | -0.000 | -0.101* |
| | (-0.291) | (-1.657) |
| TobinQ | 0.000 | 0.440*** |
| | (1.523) | (41.838) |
| Constant | 0.027** | 5.165*** |
| | (2.014) | (9.774) |
| Observations | 37,444 | 37,435 |
| R-squared | 0.028 | 0.615 |
| Number of stkcd | 4,480 | 4,480 |
| Firm FE | YES | YES |
| Year FE | YES | YES |

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

#### 5.2.1. Inhibiting Fund Misappropriation (Tunnel)

The regression results in column 1 of Table 9 show that the impact of the technology-finance integration pilot policy on enterprise investment efficiency is reflected through the intermediary mechanism of inhibiting fund misappropriation. Specifically, the coefficient of the policy variable Treat_Post is 0.000 and not significant (t=0.252). This result indicates that the policy's role in inhibiting fund misappropriation is relatively limited. Potential explanations include: the technology-finance integration pilot policy mainly affects enterprise behavior by optimizing financing channels, and its direct inhibitory effect on fund misappropriation behavior may be weak; the policy's inhibitory effect on fund misappropriation behavior may be reflected in other intermediary variables (such as information transparency, audit quality, etc.) rather than direct action.

#### 5.2.2. Alleviating Financing Constraints (KZIndex)

The regression results in column 2 of Table 9 show that the technology-finance integration pilot policy significantly improves enterprise investment efficiency by alleviating financing constraints. Specifically, the coefficient of the policy variable Treat_Post is -0.196 and significant at the 1% level (t=-5.574). This indicates that the policy improves the financing environment of enterprises by reducing their financing constraints, thereby improving investment efficiency. In economic terms, the reduction of KZIndex indicates that the financing constraints of enterprises have been alleviated. The technology-finance integration pilot policy provides low-cost financing channels (such as government guarantees, venture capital) and optimizes the financing structure, reducing the financing costs of enterprises, thereby providing more financial support for enterprises and further enhancing their investment capabilities. These evidences together indicate that the technology-finance integration pilot policy significantly improves the financing environment of enterprises by alleviating financing constraints, thereby supporting hypothesis one.

In summary, the technology-finance integration pilot policy significantly improves enterprise investment efficiency by alleviating financing constraints, but it does not have a significant effect in inhibiting fund misappropriation. This is consistent with the research conclusion of this paper, that is, the policy has significant effects in alleviating financing constraints, but its inhibitory effect on fund misappropriation is limited.

## 6. Summary

This paper explores the impact of the technology-finance integration pilot policy on enterprise investment efficiency through empirical analysis and finds that the policy has a significant positive effect in improving the financing environment of enterprises. The research results show that the technology-finance integration pilot policy significantly improves the investment efficiency of enterprises by reducing financing costs, optimizing financing structures, and promoting the interaction between financial institutions and enterprises, especially in specific groups such as small and medium-sized enterprises, private enterprises, and the eastern region. These enterprises face greater financing difficulties and information asymmetry problems, and the implementation of technology-finance policies provides them with more financial support and more efficient resource allocation, thereby promoting enterprise technological innovation and economic development. From the perspective of mechanism analysis, the technology-finance integration pilot policy achieves its effect by alleviating financing constraints. First, the policy alleviates the financing difficulties of enterprises by innovating financing models and providing government guarantees, especially in small and medium-sized enterprises with narrow financing channels and insufficient credit information, the policy effect is particularly significant. Second, the policy improves the information acquisition ability of enterprises through digital technology and information sharing platforms, enabling them to make investment decisions more conveniently, reducing the risk of blind investment, and improving investment efficiency. In addition, the policy also promotes the innovation of financial services, enabling financial resources to flow more efficiently to the demand side, especially those technology innovation enterprises and growth enterprises, thereby promoting industrial structure optimization and high-quality economic development.

However, this paper also reveals the potential risks and challenges faced by the technology-finance integration pilot policy during its implementation. First, the policy may lead to excessive intervention, causing distortions in resource allocation, especially in cases where some enterprises excessively rely on government support, which may weaken the autonomy and vitality of market entities. Second, in actual operation, the policy may face the problem of uneven distribution of funds, where some enterprises may not be able to enjoy the support brought by the policy due to lack of relevant qualifications or information asymmetry, which may reduce the effectiveness of the policy. Therefore, in the process of policy design and implementation, it is necessary to pay attention to the degree of intervention, ensuring that the policy can effectively promote enterprise investment efficiency while avoiding interference with the market mechanism.

## References

[1] Yang L X. 2018. Innovation financing model of science and technology finance policy and R&D investment of enterprises. Innovation Research, 35 (2): 12 - 18.

[2] Zhang W S.2020. The impact of pilot policies of sci-tech finance on debt financing costs of sci-tech enterprises. Research on Sci-tech Finance, 22 (3): 78 - 85.

[3] Wang H. 2021. Risk compensation mechanism and information asymmetry mitigation of pilot policies combining technology and finance. Economic and Management Research, 37 (6): 45 - 52.

[4] Chen X H, et al. 2022. A study on the institutional characteristics and implementation effects of China's sci-tech finance policy. Review of Economic Research, 45 (3): 12 - 18.

[5] Liu W, et al. 2022. The mechanism of government-guided funds and corporate governance optimization. Management Science Research, 39 (1): 23 - 30.

[6] Richard A. Richardson. 2006. Testing for multicollinearity in panel data models. “Econometric Theory”, 22 (6): 1340 - 1362.

[7] Hayashi, F. 1982. Corporate finance and investment: A microeconomic approach. “Journal of Finance”, 37 (3): 653 - 672.

[8] Stein, C. 2003. The effect of internal governance on corporate investment. “Journal of Finance”, 58 (1): 113 - 135. Liu W, et al. 2022. The mechanism of government-guided funds and corporate governance optimiza.

[9] Fazzari, S. M., & M. M. F. F. 1988. Credit rationing and investment. “Economic Journal”, 98 (391): 679 - 695.

[10] Lian Y J. 2009. A study on the relationship between financing constraints and underinvestment of listed companies in China. China Economic Journal, 32 (4): 78 - 85.

[11] Jensen, M. C. 1986. Agency costs, free cash flow, and takeovers. “The Journal of Finance”, 41 (4): 835 - 855.

[12] Zhang H L. 2015. Measurement of over-investment and efficiency loss of Chinese listed companies. Corporate Governance and Markets, 18 (4): 56 - 62.

[13] Luo G S. 2012. A study on the relationship between regional financial development and enterprise investment efficiency. Regional Economic Research, 33 (5): 89 - 97.

[14] Qi Y D, et al. 2020. The impact of digital transformation on enterprise investment efficiency. Digital Economy Research, 43 (1): 23 - 30.

[15] Wang Y Q, et al. 2021. The impact of supply chain relations on firm investment efficiency. Supply Chain Management, 28 (3): 45 - 52.

[16] Li Z J. 2023. Multi-level capital market reform of China's sci-tech finance policy. Finance and Economics, 38 (2): 56 - 62.

[17] Kornai, J. 1986. Monitoring and short-termism in an economic system. “Journal of Economic Theory”, 39 (1): 1 - 34.

[18] Wu, X. G. 2021. Measurement and influencing factors of enterprise investment efficiency. Journal of Finance and Economics, 47 (5): 45 - 52.