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The impact of different sources of science and technology finance on the innovation capability of high-tech industries in China

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Abstract: This study examines the impact of science and technology (S&T) finance inputs on the innovation capability of China's high-tech industries. Using panel data from 30 Chinese regions (2013–2022), the research employs the Entropy Weight-TOPSIS method to measure innovation capability and a fixed-effects model to analyze four financing channels: government funding, bank loans, venture capital, and capital market financing. Results show that all channels positively influence innovation, with capital market financing having the strongest effect (coefficient: 1.309), followed by government funding (0.514), venture capital (0.153), and bank loans (0.009). Regional disparities highlight higher innovation capability in eastern China. The findings suggest optimizing S&T finance policies to enhance innovation, emphasizing capital markets for mature firms and government support for early-stage ventures.

Keywords: *China, Entropy Weight-TOPSIS, Finance, High-tech industry, Innovation capability, Science and Technology.*

1. Introduction

China high-tech industries have emerged as crucial drivers of national economic transformation, yet their innovation potential remains constrained by financing challenges. The unique characteristics of technological innovation, including high risks, substantial capital requirements, and extended R&D cycles-create significant financial barriers that conventional funding mechanisms often fail to address adequately.

Science and technology finance (Sci-Tech Finance, or STF) refers to a series of policies and systematic arrangements that, through financial investment in science and technology, guide and promote various types of capitals such as financial institutions in the banking, securities and insurance industries and venture capital, innovate financial products, improve service modes, and It is a systematic arrangement of a series of policies and systems to build a service platform, realize the combination of the chain of science and technology innovation and the chain of financial capital, and provide financing support and financial services for science and technology enterprises at all stages of development from start-up to maturity [1].

Current literature has established the theoretical linkage between financial development and technological innovation, with notable contributions examining government funding, venture capital, and banking systems separately. However, these studies present three critical limitations: they typically analyze financing channels in isolation rather than comparatively; focus narrowly on national-level aggregates while ignoring regional disparities; and fail to account for China's recent capital market innovations, particularly the 2019 establishment of the Science and Technology Innovation Board (STAR Market). This fragmented approach leaves policymakers without comprehensive guidance on

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optimizing the science and technology finance ecosystem. This study bridges these gaps through a systematic examination of four financing channels (government funding, bank loans, venture capital, and capital market financing) across China's regional high-tech industries from 2013 to 2022.

The research carries important theoretical and practical implications. Theoretically, it advances the integration of financial innovation and endogenous growth theories within China's institutional context. Practically, it provides evidence-based recommendations for: (1) stage-specific financing strategies - government support for early R&D, venture capital for commercialization, and capital markets for scaling; (2) regional policy differentiation to address spatial imbalances; and (3) banking sector reforms to better serve high-tech enterprises. These insights are particularly timely as China implements its "innovation-driven development" strategy and seeks to upgrade its industrial structure.

2. Related Literature

2.1. Science and Technology Finance Impact on Innovation

The relationship between science and technology (S&T) finance and innovation has garnered significant scholarly attention in recent years. Varied impacts of different financing channels. Government R&D expenditures significantly boost innovation outputs, particularly in strategic industries [2]. Bank financing shows contradictory effects while some reported positive impacts in developing economies [3] some found negligible or negative effects for high-tech firms due to risk aversion [4, 5]. The role of venture capital has been widely documented, and S&T finance has brought new impetus to venture capital by reducing financing constraints that are particularly effective for small firms [6]. The impact of capital markets remains controversial. Capital markets can enhance innovation, while short-term market volatility can disrupt the continuity of innovative R&D [7]. However, this article puts these four channels together to recognize the mechanisms by which they interact in science and technology finance. Regional differences are another under-researched area to investigate how science and technology finance affects regional innovation capability differently. This study uses provincial panel data to fill these gaps in the literature.

2.2. Hypothesis Development

The researchers employed the guiding framework of this paper as shown in Figure 1.

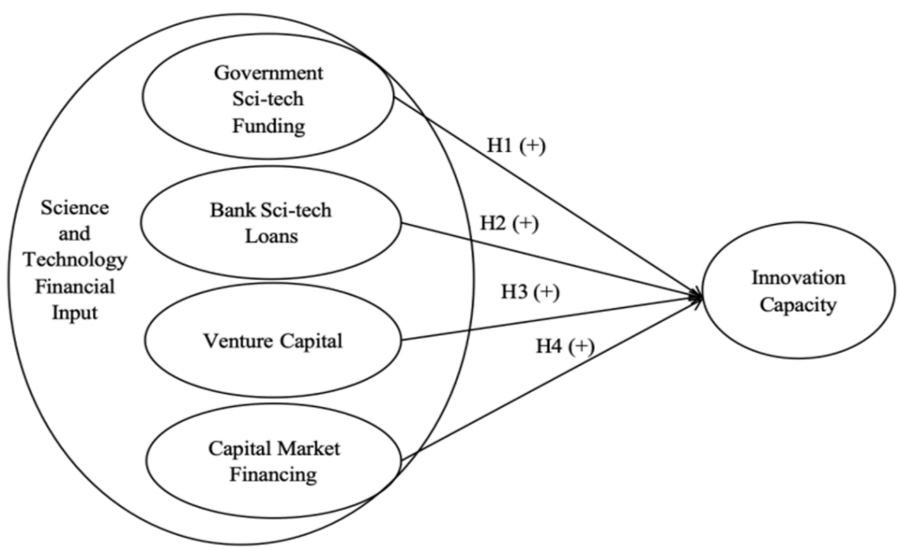

Figure 1.
Proposed model on the impact of S&T finance on innovation capability in China.

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Government science and technology funding (*Gov*) refers to the use of different means to improve the reasonable distribution of financial capital in high-tech enterprises, and the government mainly adopts the methods of direct financial subsidies, financial tax reduction free, financial subsidies and financial credit guarantee [8]. Through the establishment of preferential policy financial institutions and other means, it promotes the smooth development of the financing service activities of high-tech enterprises and improves the capital operation effect of high-tech enterprises and bring capital guarantee to the development of the company. In this paper, government fiscal input mainly refers to the national science and technology financial input and the relevant support policies. The study suggests that:

Hypothesis 1: Government science and technology funding will enhance the innovation capability of high-tech industries.

Bank science and technology loans (*Bank*) refer to financing services and financial products that commercial banks, policy banks and other financial institutions collaborate to provide to high-tech enterprises for use in R&D and innovation and other activities [9]. On the one hand, banks have the industry advantage of information collection and efficient processing. By assessing the riskiness and rate of return of innovation projects, they will select innovation projects with high investment returns, relatively controllable risks and good development prospects, and provide funding guarantee for high-quality innovation projects [10]. On the other hand, by monitoring the profitability, cash flow and other indicators of the lending enterprises, the bank supervises the operating conditions of the enterprises, promotes sound business operation and helps innovative development [11]. In addition, the information on banks technology loans is public information, which will drive the flow of social capital and expand financing channels for sci-tech innovation in high-tech industries. As a result, this study asserts that.

Hypothesis 2: Bank science and technology loans will enhance the innovation capability of high-tech industries.

Venture capital (*VC*) is a target enterprise under the professional operation of a capital management organization, obtains the maximum investment return. It has the advantages of high added value and participation by professional and excellent venture capitalists, who integrate the company's innovation ability, development potential, and the entrepreneur's management ability. Most entrepreneurial venture capital investments provide professional management for start-up stage in the form of equity investment to help them grow rapidly and gain income through capital appreciation in the process [12]. It is closely linked with high-tech industry and has a very important role in promoting the development of sci-tech innovation in China high-tech industry. Based on the above analyses, the following hypothesis is proposed.

Hypothesis 3: Entrepreneurial venture capital will enhance the innovation capability of high-tech industries.

Capital market financing (*CMF*) refers to the market for long-term capital borrowing and lending financing activities, with a long-term, high risk and other characteristics. The capital market sends messages to investors with trading prices, and profit-oriented market players will make additional investments after obtaining profits [13] and enterprises will obtain reinvestments to continue innovative activities or expand their scale of production, thus forming a virtuous investment and financing cycle of Capital Market - Enterprise [14]. China capital market mainly provides direct financing channels for high-tech enterprises through the Main Board, SME, GEM, New OTC, and the Sci-Tech Innovation Board (STB). The capital market, with its more complete financial system, provides more matching financial support for high-tech industries at different stages. Thus, the study suggests that.

Hypothesis 4: Capital market financing will enhance the innovation capability of high-tech industries.

3. Materials and Method

3.1. Research Instrument

This study is grounded in quantitative methodology. In the context of high-technology sectors, this investigation opts for the panel data of high-tech industries in China and conducts an empirical examination on how various scientific and technological financial inputs in different regions impact the advancement of innovation capabilities within high-tech industries by employing the fixed-effects model. It is difficult to collect enough data and indicators by using questionnaires, which may lead to a lack of scientific validity of the results. Therefore, this study uses data from authoritative databases for measurement and analysis, mainly from the Wind Data Service and China Statistics Yearbook.

3.2. Data Gathering

From the perspective of data availability, panel data of 30 provinces (cities and regions) are selected, data from 2013 to 2022. The data of Table 1 all gathering from China Statistics Yearbook. The data of Table 2 are gathering from China Statistics Yearbook and Wind Data Service.

Table 1.
The select of innovation capability variables.

Primary variables	Secondary variables	Tertiary variables
Innovative inputs	Financial inputs	R&D expenditure in high-tech industries (billion yuan)
	Human capital	Full-time equivalent of R&D personnel (person-years)
Innovation outputs	Innovation environment	Number of R&D organizations in high-tech industries (nos.)
	Innovation achievements	Number of Patent Applications (pieces)
		Technology market turnover (billion yuan)
	Market flows	Sales revenue of new products (billion yuan)

Table 2.
The select of sicence and technonlgy financial variables.

Variable	Representation	Treatments
Government Sci-tech Funding	*Gov*	Total sci-tech expenditures/ Total funding expenditures
Bank Sci-tech Loans	*Bank*	Commercial bank loans / Local GDP
Venture Capital	*VC*	Total VC / Local GDP
Capital Market Financing	*CMF*	Total financing number of listed companies in high-tech industries /Local GDP

3.3. Data Analysis

For data analysis, this study will be analyzed with the help of two models. The Entropy Weight-TOPSIS model to measure the innovation capability of high-tech industries, utilized SPSSAU software to analyze. Entropy Weight-TOPSIS is an evaluation model which from two dimensions of sci-tech innovation inputs and outputs. This model judges the degree of influence of indicators on the comprehensive evaluation based on the degree of variability (entropy value) of the indicators. The greater the degree of variation, the higher the entropy value, the greater the weight of the indicator. The Entropy Weight-TOPSIS avoids the subjectivity of human-assigned indicator weights, and the entropy weight method effectively overcomes human subjectivity by setting up the algorithm, making the assignment results objective.

Fixed effects modeling based on the above results. Fixed effects modeling is a method of panel data analysis. The net effect of the independent variable on the dependent variable is estimated by capturing characteristics that do not change over time. It centers on the introduction of individual fixed effects to eliminate estimation bias due to individual differences and is suitable for situations where there are unobserved factors associated with the independent variable. Analyzing with Stata17 software.

3.4. Measurement Process

The processing procedure is divided into two main parts. The first part is to analyze the innovation capability by entropy weight - TOPSIS method. The second part is to analyze the effect of different channels of science and technology finance on innovation capability by using fixed effect model.

The Entropy Weight-TOPSIS model combines the Entropy Weight method and the TOPSIS model, the principle of which is to firstly measure the weight of each indicator by the entropy value method and calculate the product of the original data of the indicator and the weight of the indicator to get the new data and then use the TOPSIS method to do a comprehensive evaluation.

Step 1. Standardization of raw data. Standardize the raw data so that data from different indicators can be compared and analyzed on the same standard. In equation 1, y_{ij} is the standardized value of the raw data, and x_{ij} is the raw data of indicator i in j area.

$$y_{ij} = \frac{x_{ij}-x_{min}}{x_{max}-x_{min}} \tag{1}$$

Step 2. Calculation of weights by Entropy method. This step involves calculating the information entropy of each indicator and calculating the weight of each indicator based on the information entropy. Information entropy is a measure of information uncertainty, and by calculating information entropy the weights of each indicator can be derived, and these weights reflect the importance of each indicator in decision making. The larger the information entropy, the smaller the weights. The smaller the information entropy, the larger the weight. In equation 2-5, w_j is the result of weight, m is the research object and n is the evaluation index, $i = 1,2,\dots,m, j = 1,2,\dots,n$.

$$e(y_i) = -\sum_{i=1}^{m}(y_{ij}\ln y_{ij}) \tag{2}$$

$$e_j = \frac{e(y_j)}{lnm} \tag{3}$$

$$d_j = 1 - e_j \tag{4}$$

$$w_j = \frac{d_j}{\sum_{j=1}^{n} d_i} \tag{5}$$

Step 3. Constructing a weighted decision matrix. w_j is the weight, y_{ij} is the standardized value of the raw data.

$$v = (v_{ij})_{m\times n}\begin{bmatrix} w_1y_{11} & w_2y_{12} & \cdots & w_ny_{1n} \\ w_1y_{12} & w_2y_{22} & \cdots & w_ny_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ w_1y_{m1} & w_2y_{m2} & \cdots & w_ny_{mn} \end{bmatrix} \tag{6}$$

Step 4. Calculate the positive and negative ideal solutions. v^+ is the positive ideal solution. v^- is the negative ideal solution.

$$v^+ = \{max\,(v_{ij}) | i = 1,2,\dots,m\} \tag{7}$$

$$v^- = \{min\,(v_{ij}) | i = 1,2,\dots,m\} \tag{8}$$

Step 5. Calculate the Euclidean Distance. $i = 1, 2, \dots, m$

$$d_i^+ = \sqrt{\sum_{j=0}^{n}(v_{ij} - v_j^{+2})} \tag{9}$$

$$d_i^- = \sqrt{\sum_{j=0}^{n}(v_{ij} - v_j^{-2})} \tag{10}$$

Step 6. Calculate the nearness degree. The larger the F_i is, the stronger the regional innovation capability is. The smaller the F_i is, the lower the regional innovation capability is.

$$F_i = \frac{d_i^-}{d_i^+ - d_i^-}, i = 1,2,\dots,m \tag{11}$$

Step 7. Descriptive Statistics. Taking China high-tech industry as the empirical object, with the time span of 2013-2022, panel data of 30 regions are selected, and descriptive statistics are analyzed based on obtaining valid samples.

Step 8. Multicollinearity test. Theoretically, if the explanatory variables are highly correlated with each other, it will increase the variance and make it difficult to distinguish their individual influence on the innovation capability of high-tech industries. Therefore, this paper tests the covariance between variables before the model is processed.

Step 9. F-tests and Horsman tests. If the p-value less than 0.05, a fixed effects model was constructed. If it is greater than 0.05, a random effects model is constructed.

Step 10. Hypothesis tests. Constructs a basic panel regression model. And in conjunction with the results of the F-tests and Hausman test. The standard model was expanded based on the results. According to the regression results, the regression coefficients and significance levels of the variables will be explained.

4. Results and Discussion

4.1. Innovation Capability Analysis

The study evaluated the innovation capability of high-tech industries in China, as indicated in Table 3. 19 out of 30 regions have innovation capability scores lower than 0.1, and only Guangdong has a score higher than 0.5, which indicates that the innovation capability of China's hi-tech industry is generally low and has large regional differences. In terms of specific regions, Guangdong is the best region in terms of innovation capability with a score of 0.763, which is much higher than other regions in China. Jiangsu's innovation capability score is 0.494, ranking behind Guangdong.

Geographically. The top five regions in terms of innovation capability are Guangdong, Jiangsu, Beijing, Zhejiang and Shandong, all of which are in eastern China. Innovation capability of the last five regions were Inner Mongolia, Ningxia, Qinghai, Hainan, Xinjiang, these five regions in addition to Hainan are in western China. This shows that. In terms of innovation capability, the east and west of China are very different, and generally show a kind of ladder-like development characteristics from west to east, which is basically consistent with the regional characteristics of China economic development.

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Table 3.
The results of innovation capability of high-tech industries.

Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
Guangdong	0.686	0.681	0.715	0.778	0.768	0.774	0.791	0.815	0.829	0.797	0.763
Jiangsu	0.528	0.541	0.556	0.595	0.481	0.430	0.418	0.439	0.451	0.496	0.494
Beijing	0.315	0.324	0.316	0.289	0.302	0.309	0.327	0.348	0.374	0.371	0.328
Zhejiang	0.235	0.236	0.266	0.276	0.237	0.222	0.238	0.254	0.272	0.320	0.256
Shandong	0.188	0.189	0.209	0.198	0.196	0.153	0.130	0.169	0.205	0.248	0.189
Shanghai	0.129	0.130	0.127	0.112	0.109	0.113	0.123	0.133	0.179	0.221	0.138
Hubei	0.094	0.104	0.116	0.106	0.108	0.116	0.130	0.142	0.163	0.202	0.128
Shannxi	0.090	0.097	0.095	0.089	0.092	0.092	0.110	0.123	0.152	0.172	0.111
Anhui	0.065	0.074	0.097	0.115	0.103	0.096	0.096	0.108	0.157	0.197	0.111
Sichuan	0.081	0.088	0.092	0.087	0.097	0.110	0.113	0.116	0.124	0.132	0.104
Fujian	0.103	0.104	0.097	0.096	0.101	0.095	0.096	0.093	0.110	0.113	0.101
Henan	0.104	0.111	0.119	0.099	0.094	0.086	0.072	0.080	0.089	0.124	0.098
Tianjin	0.101	0.104	0.107	0.078	0.067	0.063	0.069	0.079	0.088	0.100	0.086
Hunan	0.063	0.068	0.083	0.074	0.079	0.059	0.064	0.080	0.107	0.165	0.084
Jiangxi	0.034	0.038	0.043	0.049	0.054	0.067	0.079	0.085	0.089	0.119	0.066
Chongqing	0.028	0.037	0.060	0.050	0.056	0.045	0.043	0.050	0.053	0.064	0.049
Liaoning	0.053	0.051	0.047	0.039	0.041	0.043	0.044	0.049	0.056	0.062	0.049
Hebei	0.026	0.035	0.042	0.042	0.041	0.033	0.040	0.048	0.055	0.068	0.043
Heilongjiang	0.026	0.026	0.024	0.020	0.019	0.013	0.018	0.019	0.023	0.027	0.022
Guizhou	0.023	0.024	0.019	0.016	0.018	0.019	0.021	0.023	0.023	0.027	0.021
Jilin	0.016	0.013	0.011	0.014	0.019	0.026	0.033	0.031	0.010	0.008	0.018
Gansu	0.013	0.014	0.014	0.013	0.013	0.014	0.014	0.016	0.018	0.019	0.015
Guangxi	0.012	0.011	0.010	0.008	0.007	0.007	0.007	0.008	0.060	0.016	0.015
Shanxi	0.011	0.010	0.009	0.012	0.015	0.014	0.012	0.012	0.015	0.020	0.013
Yunnan	0.010	0.010	0.010	0.009	0.011	0.009	0.009	0.011	0.011	0.017	0.011
Inner Mongolia	0.005	0.003	0.005	0.005	0.005	0.005	0.002	0.003	0.004	0.007	0.004
Ningxia	0.002	0.002	0.003	0.003	0.003	0.002	0.004	0.003	0.005	0.009	0.004
Qinghai	0.003	0.003	0.005	0.005	0.005	0.006	0.001	0.001	0.001	0.003	0.003
Hainan	0.006	0.005	0.005	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.003
Xinjiang	0.001	0.002	0.002	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.001

4.2. Science And Technology Finance Effect on the Innovation Capability Analysis

4.2.1. Descriptive Statistics

From the results of descriptive statistics in Table 4, there is a zero value of innovation capability, which does not mean that the high-tech industry in a certain region does not have innovation capability in a certain year, but due to the fact that the results of the measurements are finally presented at the fourth decimal place, and the values that are very small but not equal to zero are zeroed out. At the same time, it also shows that the gap in innovation capability of high-tech industries between different regions is obvious, and the median and average can also show that the innovation capability of each province is insufficient. From the perspective of science and technology financial input, the median and the mean reflect the large difference between different science and technology financial inputs, and from the maximum and minimum values, there is a significant difference between the regions.

Table 4.
Descriptive statistics.

Variable	Count	Min.	Max.	Median	Average	St. dev
Inv	300	0.0000	0.8290	0.0575	0.1108	0.1635
Gov	300	0.0048	0.0682	0.0162	0.0224	0.0154
Bank	300	0.7433	2.7741	1.4858	1.5690	0.4301
VC	300	0.0000	0.1072	0.0033	0.0078	0.0140
CMF	300	0.0003	0.0208	0.0027	0.0036	0.0030

4.2.2. Multicollinearity Test

VIF is the variance inflation factor of the explanatory variables, if VIFmax<10, it means that multicollinearity does not exist. The results are shown in Table 5, the maximum VIF is 2.23, and the VIF value is much less than 10, which indicates that there is no multicollinearity among these four explanatory variables.

Table 5.
Multicollinearity Test (<10).

Variable	VIF	1/VIF
Bank	1.26	0.791049
Gov	1.53	0.655665
VC	2.06	0.485576
CMF	2.23	0.448874
Mean VIF	1.77	

4.2.3. F-Tests and Horsman Tests

F-tests and Horsman tests were performed before running the model. F(29, 263) = 37.21 was obtained by F-test and its significance Prob=0.000, significantly < 0.05, significance passed. Hausman test result Prob=0.000, less than 0.05, significance passed. Both F-test and Hausman test passed, indicating that this paper should choose to use fixed effect model.

Table 6.
F-test Result.

Inv	Coef.	St. Err.	t-value	p-value	[95% Conf.	Interval]	Sig.
Gov	0.514	0.251	2.05	0.042	0.019	1.009	**
Bank	0.009	0.007	1.30	0.195	-0.005	0.023	
VC	0.153	0.216	0.71	0.479	-0.273	0.579	
CMF	1.309	0.697	1.88	0.062	-0.064	2.682	*
Constant	0.052	0.01	5.18	0	.032	0.071	***
Mean dependent var		0.111	SD dependent var		0.164		
R-squared		0.409	Number of obs		300		
F-test		26.029	Prob > F		0.000		
Akaike crit. (AIC)		-1563.937	Bayesian crit. (BIC)		-1534.307		
Significant level: *** p<.01, ** p<.05, * p<.1							
F test that all u_i=0: F (29, 263) = 37.21 > Prob > F = 0.0000, significantly < 0.05.							

Table 7.
Horsman Tests Results.

	Coefficients ----			
	(b) (B)	(b-B)	sqrt (diag (V_b	V_B))
	fe re	Difference	Std. errs.	
Gov	0.5140054 1.396045	-0.8820397	0.2475785	
Bank	0.0091869 -0.0292607	0.0384476	0.0070082	
VC	0.1531351 1.216695	-1.06356	0.1794277	
CMF	1.309247 1.545108	-0.2358611	0.3598755	
Significant level: chi2(4) = (b-B)'[(V_b-V_B) ^(-1)](b-B) = 58.07				
Prob > chi2 = 0.0000， significantly < 0.05				

4.2.4. Fixed Effect Model Performs

As can be seen from Table 8, the model identifies as shown in Figure 2, the model identifies the impact of technology finance on innovation capability.

Government S&T financial has a significant positive effect on innovation capability at 0.514. This verifies the applicability of the supply-led theory [15] that the government, as a dominant player in

S&T innovation, can promote firms' innovation activities through policies. It also proves that the government's supportive policies for innovative activities (direct financial support, tax and fee reduction, and government special funds) are effective. Thus, H1 is supported.

The promotion effect of bank loans on innovation capability is the lowest among the four channels, which is 0.009. It indicates the limited effect of bank loans on innovation capability. This reflects the fact that high-tech industries are difficult to rely on traditional financing channels because of their high-risk and high-input characteristics. This is consistent with the theory of financial innovation [16] indicating the need for more targeted financial products. It's support H2.

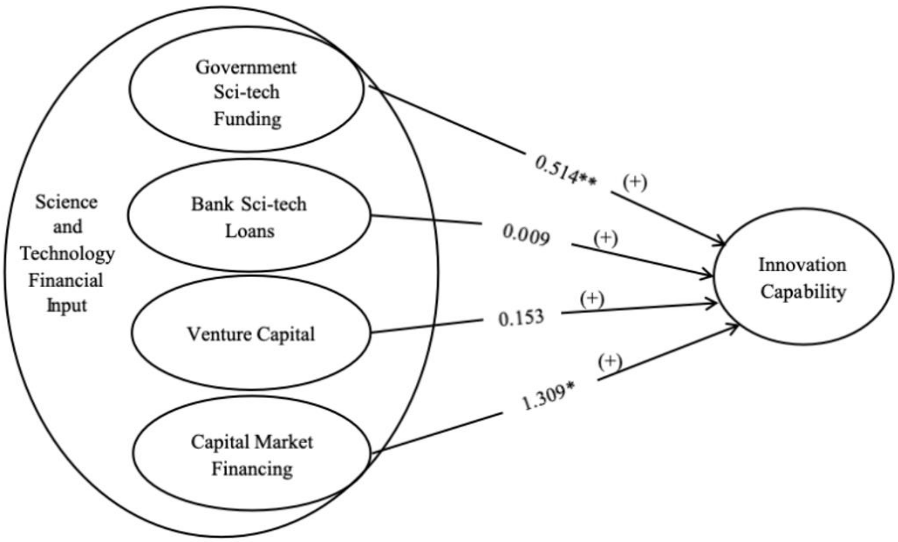

Figure 2.
Research model on the impact of S&T finance on innovation capability in China.

Venture capital has a certain positive impact on innovation ability, which is 0.153. Venture capital institutions can directly participate in the management of innovation projects, supervise the use of funds, and promote technological innovation in high-tech industries to enhance their innovation capability. However, entrepreneurial venture capital is mainly oriented to enterprise innovation projects in the incubation period. Thus, H3 is supported.

Capital market financing greatly improves the innovation capability of high-tech enterprises, which is 1.309, verifying the demand-following theory of market-driven innovation and indicating that market-driven capital flows to high-potential enterprises are effective. This finding is inconsistent with the results of previous studies [17]. The reason for this is that all the studies on the impact of capital market financing on corporate innovation predate 2019, however, with the establishment of the Science and Technology Innovation Board (STIB) and the Bejing Stock Exchange (BSE) after 2019, China's capital market system has continued to improve [18]. This result also shows that the STEM board effectively solves the financial difficulties of high-potential technology-based SMEs. Therefore, H4 is supported.

Table 8.
Fixed Effect Model Perform Result.

	Inv
Gov	0.514**
	-2.046
Bank	0.009
	-1.298
VC	0.153
	-0.708
CMF	1.309*
	-1.878
_cons	0.052***
	-5.182
N	300
R2	0.409
F	26.029

Note: ***p<0.01", "**p<0.05", "*p<0.10.

4.3. Implications

This study takes high-tech industry as the research object, analyzes the theoretical mechanism of science and technology finance on science and technology innovation and puts forward the research hypotheses, takes science and technology financial input as the perspective, and specifically explores the influence of different channels of science and technology financial input on the effect of its different roles. For the academic community, it is conducive to expanding and deepening the related research on science and technology finance and enriching the quantitative research results of science and technology financial services on science and technology innovation of high-tech industry at the micro level. For policy makers, it can provide valuable reference for the country to build and improve the science and technology financial system at the macro level. For high-tech enterprise managers, more rational allocation of science and technology financial resources. For financial institutions, to innovate financial products and provide more accurate financial services for high-tech enterprises.

5. Conclusion

Innovation-driven economic development requires the joint efforts of all subjects. Innovative activities are different from general production activities, which begin with technology and end with capital [19]. It is difficult to sustain innovation without financial support, and finance without sci-tech innovation will have a locking effect [20] so we should continue to promote the in-depth integration of sci-tech innovation and finance, and the two promote each other and work together to form a good investment and financing cycle to enhance the innovation ability of each subject [21].

This paper takes science and technology financial inputs as a perspective and divides them into government financial science and technology inputs, bank science and technology loans, entrepreneurial venture capital and capital market financing according to different channels of funding sources. Taking high-tech industries as a sample, it analyzes the different impacts of different S&T financial inputs on enhancing their innovation capability.

The results reflect the reality that the overall innovation capability of China high-tech industry is low and has significant inter-regional differences. And the innovation capability is closely related to the support of local government for innovation activities [22] which is in line with the actual development situation. Capital market financing and government financial inputs significantly enhance the innovation capability [23] of high-tech industries, while venture capital and bank loans do not have a significant role in promoting innovation, especially bank loans have a limited role in innovation.

Recommendations are provided for firms seeking financial support at different stages of innovation based on the significant differences in the facilitation of the four channels of science and technology finance. Government financial support should be sought at the start-up stage [24] venture capital at the achievement transformation stage, commercial bank loans at the post-transformation stage, and capital market financing at the industrial stage [25].

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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