

Impact of Policy Signals on Business Performance: An Empirical Analysis of Financial Subsidy Effects on High-tech Enterprises Using Panel Data from 2095 Listed Companies

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Abstract. Based on the samples of A-share listed companies with high-tech certification from 2017 to 2021, this study empirically analyzes the influence of financial subsidy as a "policy signal" on the business performance of high-tech enterprises by analogy with Shannon-Weaver communication model. Using the regulatory effect model and intermediary effect model, and with the help of soft budget constraint and diminishing marginal revenue theory, this study analyzes the reasons why financial subsidy affects the enterprise business performance differently. This study indicates that financial subsidy, as a kind of policy signal source, is regulated by the nature and scale of enterprises, and ultimately improves the financial performance and innovation performance of enterprises through the intermediary effect of R&D investment intensity and external market valuation.

Keywords: financial subsidy, high-tech enterprises, policy signals, soft budget constraints, diminishing marginal returns, financial performance, innovation performance.

1. Introduction

At present, a new round of scientific and technological revolution and industrial transformation is at the historical juncture of achieving a major breakthrough. The new scientific and technological revolution has formed a historic intersection with China's promotion of high-quality development. China's innovation is facing new challenges and opportunities, and high-tech enterprises play an important strategic role in it. At present, China's high-tech enterprises have played an important role in changing the development mode, enhancing the ability of independent innovation, optimizing the industrial structure, and enhancing international competitiveness. They have explored effective ways to closely integrate science and technology with the economy, and are gradually realizing the transformation from promoting the industrialization of science and technology to paying more attention to the source of innovation and from integrating into the main battlefield of the economy to supporting the development and security of the country more actively. However, in the face of severe tasks such as high-quality development, high-level scientific and technological self-reliance, steady growth and employment protection, high-tech enterprises still need to further improve their business performance and development quality.

The choices made by high-tech enterprises in their innovation process are obviously different from those made by traditional enterprises in perfect competition, and will be influenced by many non-technical factors, such as policy behavior, material and human capital, spillover effect, public policy, imitation and cooperative research [1]. The "endogenous growth theory" put forward by development economists regards technological progress as the decisive factor to promote economic growth [2-3], and the spillover effect generated in the process of technology research and development and application makes it have the characteristics of positive externalities. However, it is difficult to form the optimal incentive by relying solely on market forces, and the government needs to adopt policy tools to adjust it. The evaluation of financial subsidy effect is related to the efficiency and accuracy of government macroeconomic intervention, and is of great value for perfecting the definition of government and market functions under the condition of market economy [4]. At the same time, the effectiveness of financial subsidy as a macro-policy tool for micro-subjects is an important embodiment of the level of national governance, and the business performance of high-tech

enterprises is an important measure to measure the efficiency and accuracy of financial subsidy as a policy tool, so the influence effect and mechanism of financial subsidy on enterprise business performance are worth exploring.

There are two main aspects in the business performance of high-tech enterprises: first, as the stabilizer of macroeconomic growth and the main force to ensure employment and promote entrepreneurship, high-tech enterprises should focus on enhancing their financial performance and give full play to their important supporting role in stabilizing the basic economy. Secondly, high-tech enterprises need to enhance their innovation strategy ability, strengthen their leading and exemplary role in self-reliance and self-improvement of high-level science and technology, improve their innovation performance, and rely on scientific and technological innovation to strengthen their foundation. Based on the above considerations, this study defines the business performance of high-tech enterprises as financial performance and innovation performance.

2. Theoretical Summary

The academic field has partially discussed the influence of financial subsidy on the performance of high-tech enterprises. Ma Weihong (2011) [5] uses the panel data model of random effects to analyze the impact of tax incentives and government subsidies on R&D investment of high-tech enterprises, and finds that tax incentives are more important. Lu Dong, Lin Gao and Yang Dan (2012) [6] found that the high-tech enterprises in the GEM did not effectively invest the resources given by the government in technology R&D, and political connections weakened the R&D and innovation capabilities of enterprises, which failed to improve the market value of enterprises. Zheng Chunmei and Li Pei (2015) [7] empirically analyzed the impact of government financial incentive policies on the innovation performance of small and medium-sized high-tech enterprises, and compared the incentive effects of two main policy tools, namely government subsidies and tax incentives. Bi Xiaofang, Zhai Shuping and Jiang Baoqiang (2017) [8] found that government subsidy and financial redundancy have a significant role in promoting the exploratory innovation investment of enterprises. The existing research results are rich, and most of them discuss the performance of high-tech enterprises from the perspectives of R&D investment and innovation ability, but ignore the influence of financial subsidy as a "policy signal" on listed companies and the intermediary effect on the internal and external environment of enterprises in the information asymmetry market, and fail to analyze the mechanism of financial subsidy affecting the performance of high-tech enterprises.

The study draws inspiration from Shannon-Weaver Model [9]. Shannon and Weaver put forward it for the first time in Mathematical Theory of Communication. In this model, a message sent by a source is converted into a signal that can be transmitted by a transmitter. After transmission, the received signal is restored to a message by a receiver and transmitted to a destination. In this process, the message may be disturbed by noise, resulting in some attenuation and distortion [10]. By analogy with the Shannon-Weaver model, we can propose the impact mechanism of financial subsidy on the business performance of high-tech enterprises from the perspective of "policy signals". Financial subsidy, as a policy signal source, transmit signals to the high-tech enterprises through the mediation of channels and the adjustment of noise.

The value of this study lies in firstly introducing "policy signal" to define the behavior of financial subsidy and discussing the mechanism of financial subsidy's influence on enterprise performance from this perspective, which builds a new bridge for understanding the relationship between financial subsidy as a macro-policy means and micro-subjects of enterprises, explores a new perspective for understanding the mechanism of financial subsidy's influence on the business performance of high-tech listed companies, and provides theoretical support and practical guidance for the government to formulate enterprise subsidy policies more reasonably and apply them to the improvement of enterprise performance. Secondly, using the latest 2095 samples from 2017 to 2021, this study analyzes the latest progress of high-tech enterprises in recent five years; Thirdly, the theoretical explanation of diminishing marginal benefit and soft budget constraint is applied to the real situation,

and the regulatory effect of enterprise nature and enterprise scale on the relationship between financial subsidy and business performance is discussed. Finally, it focuses on maximizing the effect of financial subsidy, in order to solve the problem of "whether the financial subsidy is effective, who is effective and how to make it more effective".

3. Research Design

3.1. Hypotheses and Theoretical Model

3.1.1. Analysis of Main Effect

Research shows that the financial performance of enterprises can be improved by strengthening financial subsidies of local governments, and there is a positive relationship between financial subsidy and financial performance of enterprises [11]. Further research shows that although the government strengthens financial subsidies, it can not improve the performance level of enterprises, but it can enhance the solvency of enterprises [12].

Based on this, the hypotheses can be put forward:

H1_a: Financial subsidy positively affects the financial performance of high-tech enterprises.

H1_b: Financial subsidy positively affects the innovation performance of high-tech enterprises.

3.1.2. Analysis of Regulatory Effect

The effect of policy subsidy depends not only on the strength, methods and means of subsidy but also on the heterogeneity of enterprise ownership types. Compared with non-state-owned enterprises, state-owned enterprises need to actively respond to policy guidance and bear policy burdens while taking into account economic interests, thus having multiple goals [13]. They also have the status of controlling shareholders and public policy makers, which makes them more aware of the policy signal of financial subsidy and may have greater availability for government policies and financial support [14]. The relationship between state-owned enterprises and the government is inherently close, and the degree of information asymmetry between them is low. It is not only easier to obtain financial resources such as innovation subsidies and low-interest bank loans [15], but also easier to improve business performance.

Guo Bin (2006) [16] takes China's software industry as the research object, and finds that the enterprise scale has a consistent positive impact on the output rate, and there is an observable scale effect. Wu Chen (2009) [17] proves that the scale of enterprises is positively related to business performance. Lu Guoqing (2011) [18] concluded that the larger the equity scale of listed companies in strategic emerging industries in the small and medium-sized board market, the better their performance, and there is a scale effect. Ling Jianghuai and Hu Wenrong (2012) [19] concluded that strategic emerging industries have moderate scale and are easy to achieve economies of scale. It can be inferred that after obtaining financial subsidies, high-tech enterprises can give full play to the advantages of technological innovation, and ensure that enterprises always enjoy scale rewards in the process of expanding their operations, which is conducive to the improvement of their business performance.

Based on this, the hypotheses can be put forward:

H2_a: Enterprise nature positively regulates the influence of financial subsidy on financial performance.

H2_b: Enterprise scale positively regulates the influence of financial subsidy on financial performance.

H2_c: Enterprise nature positively regulates the influence of financial subsidy on innovation performance.

H2_d: Enterprise scale positively regulates the influence of financial subsidy on innovation performance.

3.1.3. Analysis of Intermediary Effect

For the outside of high-tech enterprises, government financial subsidies show their strong financial strength and good image, so they are regarded by the market as a signal of good prospects for the company; For enterprises, financial subsidy is an important driving force for enterprises to increase the R&D investment intensity. Therefore, based on the theoretical explanation of the policy signal, the policy signal of financial subsidy will be received by enterprises inside and outside, and the business performance of enterprises will be improved by strengthening the R&D investment intensity inside and improving the market valuation of enterprises outside.

Based on this, the hypotheses can be put forward:

H3a: Financial subsidy positively affects the R&D investment intensity of enterprises.

H3b: Financial subsidy positively affects the market valuation of enterprises.

H3c: R&D investment intensity positively affects the financial performance of enterprises.

H3d: R&D investment intensity positively affects the innovation performance of enterprises.

H3e: Enterprise market valuation positively affects the financial performance of enterprises.

H3f: Enterprise market valuation positively affects the innovation performance of enterprises.

To sum up, the theoretical framework of this study is shown as follows:

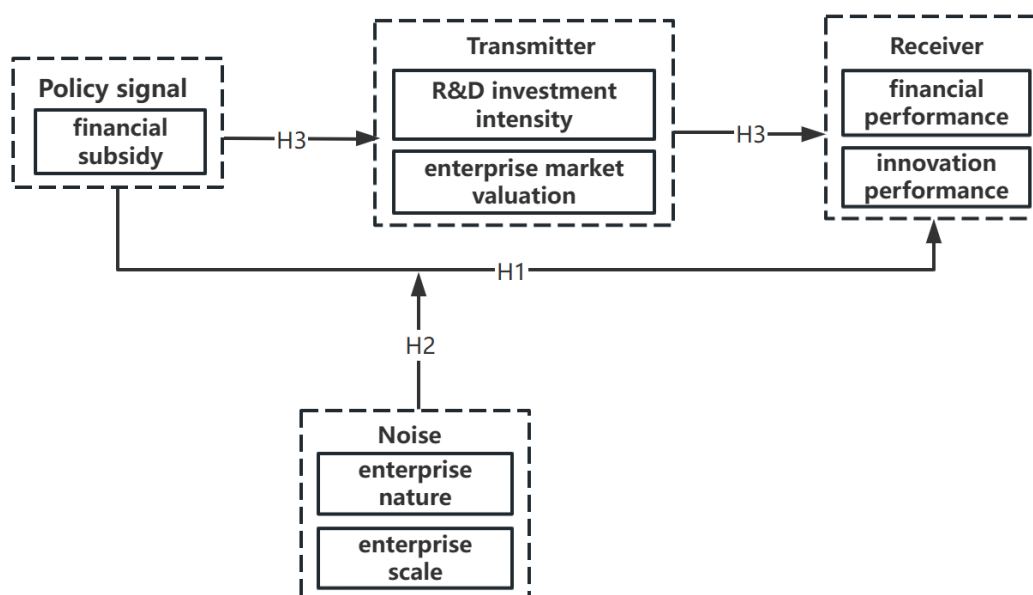


Figure 1. Research Framework

3.2. Variable Selection and Data Sources

3.2.1. Explained Variable

Business performance includes financial performance and innovation performance. The commonly used indicators to measure the profitability of enterprises mainly include ROA [20], which reflects the profitability of total assets. Therefore, this study uses ROA to measure the financial performance of enterprises. The existing literature mostly uses patent output and new product output value to measure the innovation performance of enterprises, referring to the definition of core technology by existing authoritative scholars [22-23], and the number of invention authorizations is the representative of the innovation output of core technology. Therefore, this study uses the number of enterprise invention patents to measure the substantive innovation performance.

3.2.2. Explanatory Variable

Financial subsidy. In the measurement of financial subsidy policy, this study refers to the viewpoint of Wu Jian and others [24], and measures the amount of government subsidies obtained by enterprises in that year by taking the natural logarithm. Based on the availability of data, the financial subsidy data disclosed in the enterprise financial report is adopted, which mainly includes related

indicators such as research funds, tax refund, project subsidies and various awards. In this study, the financial subsidies obtained by each enterprise every year are summed up, and the natural logarithm of the total amount of financial subsidies is taken.

3.2.3. Regulatory Variable

Enterprise nature and scale. In this study, the virtual variable of enterprise nature is introduced, and the value of state-owned enterprises is 1 and that of non-state-owned enterprises is 0. The scale of an enterprise is measured by the number of employees.

3.2.4. Intermediary Variable

Enterprise market valuation and enterprise R&D investment intensity. Tobin q value is the ratio of the market value of an asset to its replacement value, which can measure whether the market value of an asset is overestimated or underestimated. The higher the Tobin Q value, it shows that the more investors recognize the growth ability of the enterprise, the lower the relative cost of financing by issuing additional shares [25], which can better measure the intermediary effect of the external financial subsidy policy signal. Dai Xiaoyong (2014) [26] expresses the R&D investment intensity by the ratio of annual R&D expenditure to annual sales income. Compared with the total index, the R&D investment intensity can not only better reflect the adaptation of enterprise R&D investment to enterprise scale and market position, but also better measure the intermediary effect of financial subsidy policy signals within enterprises.

3.2.5. Controlled Variable

There are many factors that affect the business performance of listed companies. Referring to the existing research results [27-29], regional GDP, fixed assets of enterprises, enterprise age and asset-liability ratio are selected as controlled variables.

Table 1. Description and definition of variables

Variable type	Name	Symbol	Definition and Calculation Method
Explained variable	financial performance	ROA	Net profit/total assets
	innovation performance	Innov	Number of enterprise invention patents
Explanatory variable	financial subsidy	sub	The total amount of financial subsidies obtained by enterprises takes the natural logarithm.
Regulatory variable	enterprise nature	en	State-owned enterprises are 1; Non-state-owned enterprises are 0
	enterprise scale	size	Number of employees in enterprises
Intermediary variable	R&D investment intensity	rdi	Total R&D expenditure/operating income of enterprises
	enterprise market valuation	tq	Enterprise market value/asset replacement cost
Controlled variable	gross regional product	gdp	The natural logarithm is taken for the GDP of the city where the enterprise is registered.
	enterprise fixed assets	fix	The net fixed assets of an enterprise take the natural logarithm.
	enterprise age	age	Statistical year-year of enterprise establishment
	asset-liability ratio	lev	total liabilities/total assets
	year	time	Control the annual fixed effect
	industry	ind	Control industry fixed effect

3.3. Sample Selection

Considering the availability of data and the continuity of time, because the information disclosure of listed companies is relatively standardized, it is convenient to collect data on financial subsidy and

corporate performance. Therefore, in this study, 2,095 listed companies with high-tech certification in A-shares (including Shanghai Stock Exchange, Shenzhen Stock Exchange, Growth Enterprise Market and science and technology innovation board) from 2017 to 2021 were selected, corresponding to 10,475 strongly balanced panel samples. The data comes from the annual report of listed companies, CSMAR database and Wind database.

In order to ensure the reliability of data, the following screening was carried out: (1) Excluding ST (the company suffered losses for two consecutive years, which was specially treated) and *ST (the company suffered losses for three consecutive years, and was given a delisting warning); (2) Exclude companies whose samples have been in business for less than five years, and have abnormal values and missing values; (3) Excluding the samples of companies with negative ROA values for three consecutive years.

3.4. Model Construction

Firstly, we test the influence of financial subsidy on business performance (H1). This study sets the following econometric model. Among them, Y represents the business performance of an enterprise, including financial performance and innovation performance, i represents the enterprise, t represents the year, $Control$ represents the controlled variables, μ_i represents the industry fixed effect and μ_t represents the annual fixed effect, ε is a random disturbance term.

$$Y = \alpha_0 + \alpha_1 sub_{i,t} + \alpha_k \sum Control_{i,t} + \mu_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

Secondly, to test the regulatory effect (H2) of enterprise nature on enterprise scale, this study sets the following 2-3 econometric models, and T represents regulatory variables, namely enterprise nature and enterprise scale.

$$Y = \beta_0 + \beta_1 X_{i,t} + \beta_k \sum Controls_{i,t} + \mu_i + \mu_t + \varepsilon_{i,t} \quad (2)$$

$$Y = \beta_0 + \beta_1 X_{i,t} + \beta_2 T_{i,t} + \beta_3 X_{i,t} * T_{i,t} + \beta_k \sum Controls_{i,t} + \mu_i + \mu_t + \varepsilon_{i,t} \quad (3)$$

Finally, the intermediary effect (H3) between R&D investment intensity and market valuation is tested, and the following 4-6 econometric models are set based on the classic three-step method of intermediary test [30] of Wen Zhonglin et al. (2004). The first step is to test whether financial subsidy can significantly improve the financial performance and innovation performance of enterprises, and this result has been verified. The second step is to test whether financial subsidy can significantly improve the R&D investment intensity and market valuation of enterprises. The third step is to test the effects of R&D investment intensity, market valuation and financial subsidy on business performance. Among them, Z represents the intermediary variables, that is, the enterprise R&D investment intensity and enterprise market valuation.

$$Y = \gamma_0 + \gamma_1 sub_{i,t} + \gamma_2 \sum Controls_{i,t} + \mu_i + \mu_t + \varepsilon_{i,t} \quad (4)$$

$$Z = \partial_0 + \partial_1 sub_{i,t} + \partial_2 \sum Controls_{i,t} + \mu_i + \mu_t + \varepsilon_{i,t} \quad (5)$$

$$Y = \tau_0 + \tau_1 sub_{i,t} + \tau_2 Z_{i,t} + \tau_3 \sum Controls_{i,t} + \mu_i + \mu_t + \varepsilon_{i,t} \quad (6)$$

4. Empirical Results Analysis

4.1. Descriptive Statistics and Correlation Analysis

STATA17.0 software is used for descriptive statistical analysis of the above variables. Table 2 reports the descriptive statistical results of the main variables. From the maximum, minimum and

standard deviation of the main variables, it can be seen that there are great differences among enterprises. Among them, the minimum value of enterprise innovation performance is 0, the maximum value is 8727, and the standard deviation is 267.3, which indicates that the innovation performance of high-tech enterprises is quite different. The median innovation performance is far less than its average, which shows that the innovation performance of most high-tech enterprises is still at a low level. The minimum value of enterprise scale is 17, the maximum value is 294013, and the standard deviation is 12616, which indicates that different enterprise scales are quite different.

Table 2. Descriptive Statistics

Variable	N	Mean	p50	SD	Min	Max
<i>ROA</i>	10475	0.0310	0.0400	0.162	-4.782	7.446
<i>Innov</i>	10475	48.89	11	267.3	0	8727
<i>sub</i>	10471	16.11	16.37	2.672	0	22.27
<i>en</i>	10475	0.252	0	0.434	0	1
<i>size</i>	10475	4455	1818	12616	17	294013
<i>rdi</i>	10475	0.0580	0.0430	0.0610	0	3.077
<i>tq</i>	10475	2.090	1.576	1.918	0.0350	33.13
<i>gdp</i>	10475	10.87	10.94	0.639	7.207	11.73
<i>fix</i>	10443	20.11	20.08	1.545	10.54	26.15
<i>age</i>	10475	20.20	20	5.555	6	66
<i>lev</i>	10475	0.399	0.390	0.204	0.0100	4.995

As shown in Table 3, there is a significant positive correlation between the two explained variables and the explained variables within the 99% confidence interval. It shows that financial subsidy can improve the company's financial performance and innovation performance without controlling other factors, which initially supports hypothesis 1. The maximum correlation coefficient between variables is below 0.7, and the VIF values of variables are all below 10. It is preliminarily judged that there is no serious multicollinearity problem among variables in this model, and an empirical analysis can be made.

Table 3.Correlation Analysis

	<i>ROA</i>	<i>Innov</i>	<i>sub</i>	<i>en</i>	<i>size</i>	<i>rdi</i>	<i>tq</i>
<i>ROA</i>	one						
<i>Innov</i>	0.0140	1					
<i>sub</i>	0.061***	0.117***	1				
<i>en</i>	-0.028***	0.067***	0.073***	1			
<i>size</i>	0.020**	0.438***	0.185***	0.087***	1		
<i>rdi</i>	-0.134***	0.017*	0.00200	-0.099***	-0.050***	1	
<i>tq</i>	0.086***	-0.058***	-0.097***	-0.168***	-0.103***	0.298***	1
<i>gdp</i>	0.020**	0.026***	-0.0130	-0.160***	0.0110	0.00800	0.032***
<i>fix</i>	0.041***	0.219***	0.340***	0.234***	0.408***	-0.233***	-0.360***
<i>age</i>	-0.021**	0.083***	0.061***	0.171***	0.081***	-0.063***	-0.105***
<i>lev</i>	-0.336***	0.108***	0.090***	0.189***	0.176***	-0.156***	-0.321***
<i>gdp</i>	<i>fix</i>	<i>age</i>	<i>lev</i>				
<i>gdp</i>	1						
<i>fix</i>	-0.052***	1					
<i>age</i>	0.020**	0.183***	1				
<i>lev</i>	-0.0120	0.298***	0.105***	1			

*** p<0.01, ** p<0.05, * p<0.1

*, ** and *** indicate significant at 10%, 5% and 1% levels respectively, and t value is in brackets

4.2. Benchmark Model

A benchmark model is established based on the relationship between two interpreted variables and explanatory variables. Because the model data is panel data, mode selection is needed. Firstly, the individual effect is tested, which shows that the mixed OLS model is better than the fixed effect. Secondly, the time effect is tested, and the results show that the mixed OLS model is also better than the random effect. Finally, houseman test was carried out, and finally the mixed OLS model with the best regression effect was selected. In addition, in order to control the impact of macro-economy and the differences at the industry level, this study refers to Guo Yue's [31] practice, adds industry fixed effect and time fixed effect, and constructs a two-way fixed effect model.

Considering the heteroscedasticity in linear regression analysis, in order to prevent the model from overreacting to heteroscedasticity, this study follows the suggestion of Chen Qiang [32] and adopts OLS Robust command for regression. From the results, we can see that although there are theoretically negative effects (for example, increasing financial pressure) and positive effects (for example, gaining market reputation and political resources) on the impact of financial subsidy on business performance, the overall positive effects are more important. Table 4 lists the regression results of the main effects of financial subsidy on business performance: the results in columns (1)-(4) all show that there is a significant positive correlation between financial subsidy and the company's financial performance and innovation performance within the confidence interval of 99%. Therefore, the correctness of H1 is verified.

Table 4. Principal Effect Analysis

	(1)	(2)	(3)	(4)
	<i>ROA</i>	<i>ROA</i>	<i>Innov</i>	<i>Innov</i>
<i>sub</i>	0.00293*** (0.000589)	0.00276*** (0.000590)	5.256*** (1.042)	5.041*** (1.045)
<i>gdp</i>	0.00593*** (0.00226)	0.00463** (0.00231)	15.12*** (3.990)	18.51*** (4.086)
<i>fix</i>	0.0142*** (0.00105)	0.0158*** (0.00113)	31.58*** (1.852)	35.83*** (2.002)
<i>age</i>	-0.000229 (0.000264)	-0.000355 (0.000273)	1.959*** (0.467)	2.473*** (0.483)
<i>lev</i>	-0.292*** (0.00741)	-0.307*** (0.00775)	59.88*** (13.10)	63.67*** (13.73)
<i>_cons</i>	-0.245*** (0.0319)	-0.250*** (0.0337)	-898.7*** (56.52)	-1,030*** (59.66)
Industry fixed effect	not control	control	not control	control
Annual fixed effect	not control	control	not control	control
<i>N</i>	10,439	10,439	10,439	10,439
adj. R2	0.134	0.144	0.055	0.063

The regression results of controlled variables are basically in line with expectations: the regression coefficient of GDP in the place where the enterprise is located is significantly positive, indicating that the higher the level of economic development in the place where the enterprise is located, the more favorable it is to improve the business performance of the enterprise. The regression coefficient of fixed assets of enterprises is significantly positive, indicating that the higher the net value of fixed assets of enterprises, it may be because the fixed assets of enterprises are relatively new, the preparation for expanding reproduction is relatively sufficient, the development possibility is relatively large, and it will bring higher business performance. The regression coefficient between enterprise age and financial performance is significantly negative and the regression coefficient between enterprise age and innovation performance is significantly positive, which shows that the older the enterprise, the lower its financial performance and the higher its innovation performance. The regression coefficient between asset-liability ratio and financial performance is significantly

negative and the regression coefficient between asset-liability ratio and innovation performance is significantly positive, indicating that the higher the asset-liability ratio, the lower the financial performance and the higher the innovation performance.

4.3. Analysis of regulatory effects

Furthermore, the regulatory effect analysis is adopted, and the above classified variables are used as regulatory variables and explanatory variables for interactive analysis. As shown in Table 5, within the 95% confidence interval, the nature of enterprises (state-owned enterprises) significantly weakened the impact of financial subsidy on financial performance, and played a significant negative regulatory role, with a regulatory effect value of -0.0027. In the 99% confidence interval, the nature of the enterprise significantly enhances the impact of financial subsidy on innovation performance, and plays a significant positive regulatory role, with a regulatory effect value of 15.9905. The conclusion of the study partially verifies H2.

Soft budget constraint refers to the economic phenomenon that an economic organization can survive with the help of external organizations when it encounters financial difficulties, which corresponds to the hard budget constraint pointed by the market mechanism of survival of the fittest. Soft budget constraint includes budget constraint body and support body. Budget constraint body refers to those organizations that can't continue to exist without external assistance if their revenues fail to meet their expenditures under the premise of their own resources, which refers to state-owned enterprises here. Supporters are usually controlled by the government, and organizations that can directly transfer resources to help budget constraints in trouble point to the government. Once the state-owned enterprises in the socialist economy lose money, the government often needs to increase investment, increase loans, reduce taxes and provide financial subsidies. This phenomenon is called "soft budget constraint" by Ianos Kornai, 1986). Since Kornai (1980) put forward the concept of soft budget constraint, scholars have basically agreed that soft budget constraint will distort economic behavior and lead to the inefficiency of resource allocation [33]. It can be seen that the relationship between state-owned enterprises and the government is closer. Even if the soft and hard nature of budget constraints cannot be judged according to the nature of state-owned and private enterprises, the arrangement of property rights directly affects the strength of budget soft constraints [34].

Table 5. Regulatory Effect Analysis 1

	(1)	(2)	(3)	(4)
	ROA	ROA	Innov	Innov
<i>sub</i>	0.0035*** (0.0006)	0.0036*** (0.0006)	11.2164*** (0.9805)	10.6788*** (0.9806)
<i>en</i>	-0.0101*** (0.0037)	-0.0096*** (0.0037)	38.5172*** (6.0786)	35.2705*** (6.0787)
<i>c.sub#c.en</i>		-0.0027** (0.0013)		15.9905*** (2.1544)
<i>_cons</i>	-0.0224** (0.0097)	-0.0237** (0.0097)	-1.4e+02*** (15.9565)	-1.3e+02*** (15.9529)
Industry fixed effect	control	control	control	control
Annual fixed effect	control	control	control	control
<i>N</i>	10471	10471	10471	10471
<i>R</i> ²	0.0130	0.0133	0.0184	0.0235

It is of great theoretical and practical significance to clarify whether the scale of enterprises will regulate the influence of financial subsidy on the business performance of high-tech enterprises. As shown in Table 6, within the 95% confidence interval, the nature of enterprises (state-owned enterprises) significantly weakened the impact of financial subsidy on financial performance, and played a significant negative regulatory role, with a regulatory effect value of -0.0000; In the 99% confidence interval, the nature of the enterprise significantly weakens the impact of financial subsidy on innovation performance, and plays a significant negative regulatory role, with a regulatory effect

value of -0.0003. It can be seen that the larger the enterprise, the weaker the impact of financial subsidy on financial performance and innovation performance.

This phenomenon is a realistic explanation of the law of diminishing marginal returns in high-tech enterprises. In economics, diminishing returns means that the marginal output of the production process decreases with the increase of the number of individual production factors while keeping all other production factors equal. With the continuous expansion of production scale, the long-term average cost presents an inverted U-shaped change law, and the corresponding scale returns go through three stages in turn: increasing, constant and decreasing. In addition, the scale of enterprises will also affect technological innovation, and technological progress can react to business performance by improving the optimal production scale. With the continuous expansion of production scale, the uneconomical management of large enterprises will lead to the reduction of the efficiency of internal resource allocation and eventually offset the benefits of economies of scale [35], resulting in the phenomenon of "uneconomical scale".

Table 6. Regulatory Effect Analysis 2

	(1)	(2)	(3)	(4)
	<i>ROA</i>	<i>ROA</i>	<i>Innov</i>	<i>Innov</i>
<i>sub</i>	0.0032*** (0.0006)	0.0034*** (0.0006)	3.7169*** (0.9000)	4.3114*** (0.9019)
<i>size</i>	0.0000 (0.0000)	0.0000** (0.0000)	0.0092*** (0.0002)	0.0104*** (0.0003)
<i>c.sub#c.size</i>		-0.0000** (0.0000)		-0.0003*** (0.0000)
<i>_cons</i>	-0.0214** (0.0098)	-0.0238** (0.0098)	-52.0069*** (14.5555)	-64.5856*** (14.6317)
Industry fixed effect	control	control	control	control
Annual fixed effect	control	control	control	control
<i>N</i>	10471	10471	10471	10471
adj. <i>R</i> ²	0.0124	0.0127	0.1956	0.1993

4.4. Analysis of Intermediary Effects

Taking enterprise R&D investment intensity and enterprise market valuation as intermediary variables, Sobel method is used to test the intermediary effect, and the fixed effect of industry and year is still controlled and the panel data is regressed step by step. As shown in Table 7-10, R&D investment intensity and enterprise market valuation have significant mediating effects on the relationship between subsidy policy and innovation performance. This result means that the subsidy policy will not only directly affect the economic performance and innovation performance of enterprises, but also further enhance the financial performance and innovation performance of enterprises by enhancing the R&D investment intensity within enterprises and enhancing their market valuation outside enterprises. Therefore, the correctness of H3 is verified.

Under the condition of not joining the market valuation of enterprises, financial subsidy can significantly affect the financial performance of enterprises within 99% confidence interval, and financial subsidy can significantly affect the financial performance of enterprises within 90% confidence interval. After adding the intermediary variable of enterprise market valuation, financial subsidy will significantly affect the financial performance of enterprises within 99% confidence interval. Therefore, the intermediary effect of enterprise market valuation on the relationship between financial subsidy and financial performance of enterprises is tested, and it is a partial intermediary effect.

For enterprises, due to the large investment in innovation funds, the result is uncertain, which is a huge sunk cost for enterprises, which makes some enterprises flinch. At the same time, some enterprises with the ability to engage in technological innovation will also reduce their own innovation investment in view of the positive externalities and spillover effects of innovation

achievements, while government financial subsidy can bring positive policy signals to enterprises, bring confidence to enterprises in production and R&D investment, encourage enterprises to increase the intensity of investment in technological innovation and R&D, and then improve their business performance.

Outside the enterprise, due to the imperfect financial market system and asymmetric information, bank loans and other investors prefer applied research projects with higher returns, while some high-risk basic research projects are difficult to obtain financing. The financial subsidies affirm the innovation strength of enterprises. In addition, the government's financial subsidies for certain innovative projects also signal the future demand of public sector products to the society. When it is in line with the product innovation and service demand of enterprises, it will help to improve the expected marginal rate of return, and then improve the market valuation and business performance of enterprises.

Without joining the market valuation of enterprises, financial subsidy will significantly affect the financial performance of enterprises within the 99% confidence interval, and financial subsidy will have a significant impact on the market valuation of enterprises within the 90% confidence interval. After adding the intermediary variable of enterprise market valuation, financial subsidy will significantly affect the financial performance of enterprises within 99% confidence interval. Therefore, this study examines some intermediary effects of enterprise market valuation on the relationship between financial subsidy and financial performance of enterprises.

Table 7. Intermediary Effect Analysis 1

	(1)	(2)	(3)
	<i>ROA</i>	<i>tq</i>	<i>ROA</i>
<i>sub</i>	0.003*** (0.001)	0.011* (0.007)	0.003*** (0.001)
<i>gdp</i>	0.005** (0.002)	0.028 (0.026)	0.004* (0.002)
<i>fix</i>	0.016*** (0.001)	-0.382*** (0.013)	0.018*** (0.001)
<i>age</i>	-0.000 (0.000)	-0.010*** (0.003)	-0.000 (0.000)
<i>lev</i>	-0.307*** (0.008)	-1.987*** (0.088)	-0.297*** (0.008)
<i>tq</i>			0.005*** (0.001)
<i>_cons</i>	-0.250*** (0.034)	10.273*** (0.384)	-0.304*** (0.035)
Industry fixed effect	control	control	control
Annual fixed effect	control	control	control
N	10439.000	10439.000	10439.000
R ²	0.144	0.230	0.147
adj. R ²	0.142	0.228	0.145

Under the condition of not joining the R&D investment intensity of enterprises, financial subsidy may significantly affect the financial performance of enterprises within 99% confidence interval, and financial subsidy will significantly affect the R&D investment intensity of enterprises within 99% confidence interval. After adding the intermediary variable of R&D investment intensity, financial subsidy may significantly affect the financial performance of enterprises within 99% confidence interval. Therefore, the mediating effect of R&D investment intensity on the relationship between financial subsidy and financial performance of enterprises is tested, and it is a partial mediating effect.

Table 8. Intermediary Effect Analysis 2

	(1)	(2)	(3)
	<i>ROA</i>	<i>rdi</i>	<i>ROA</i>
<i>sub</i>	0.003*** (0.001)	0.002*** (0.000)	0.003*** (0.001)
<i>gdp</i>	0.005** (0.002)	-0.000 (0.001)	0.005** (0.002)
<i>fix</i>	0.016*** (0.001)	-0.005*** (0.000)	0.015*** (0.001)
<i>age</i>	-0.000 (0.000)	-0.000*** (0.000)	-0.000* (0.000)
<i>lev</i>	-0.307*** (0.008)	-0.033*** (0.002)	-0.316*** (0.008)
<i>rdi</i>			-0.268*** (0.030)
<i>_cons</i>	-0.250*** (0.034)	0.153*** (0.011)	-0.209*** (0.034)
Industry fixed effect	control	control	control
Annual fixed effect	control	control	control
N	10439.000	10439.000	10439.000
R ²	0.144	0.211	0.150
adj. R ²	0.142	0.209	0.148

Under the condition of not joining the market valuation of enterprises, financial subsidy will significantly affect the innovation performance of enterprises in the 99% confidence interval, and financial subsidy will significantly affect the market valuation of enterprises in the 90% confidence interval. After adding the intermediary variable of enterprise market valuation, financial subsidy will significantly affect the innovation performance of enterprises within 99% confidence interval. Therefore, the intermediary effect of enterprise market valuation on the relationship between financial subsidy and enterprise innovation performance is tested, and it is a partial intermediary effect.

Table 9. Intermediary Effect Analysis 3

	(1)	(2)	(3)
	<i>Innov</i>	<i>tq</i>	<i>Innov</i>
<i>sub</i>	5.041*** (1.045)	0.011* (0.007)	4.968*** (1.045)
<i>gdp</i>	18.514*** (4.086)	0.028 (0.026)	18.335*** (4.083)
<i>fix</i>	35.831*** (2.002)	-0.382*** (0.013)	38.280*** (2.083)
<i>age</i>	2.473*** (0.483)	-0.010*** (0.003)	2.538*** (0.483)
<i>lev</i>	63.671*** (13.732)	-1.987*** (0.088)	76.420*** (14.050)
<i>tq</i>			6.416*** (1.521)
<i>_cons</i>	-1029.506*** (59.661)	10.273*** (0.384)	-1095.420*** (61.627)
Industry fixed effect	control	control	control
Annual fixed effect	control	control	control
N	10439.000	10439.000	10439.000
R ²	0.063	0.230	0.065
adj. R ²	0.061	0.228	0.063

Under the condition of not joining the R&D investment intensity of enterprises, financial subsidy may significantly affect the innovation performance of enterprises within 99% confidence interval, and financial subsidy will significantly affect the R&D investment intensity of enterprises within 99% confidence interval. After adding the intermediate variable of R&D investment intensity, financial subsidy will significantly affect the innovation performance of enterprises within 99% confidence interval. Therefore, the mediating effect of R&D investment intensity on the relationship between financial subsidy and enterprise innovation performance is tested, and it is a partial mediating effect.

Table 10. Intermediary Effect Analysis 4

	(1)	(2)	(3)
	<i>Innov</i>	<i>rdi</i>	<i>Innov</i>
<i>sub</i>	5.041***	0.002***	4.430***
	(1.045)	(0.000)	(1.047)
<i>gdp</i>	18.514***	-0.000	18.664***
	(4.086)	(0.001)	(4.077)
<i>fix</i>	35.831***	-0.005***	37.581***
	(2.002)	(0.000)	(2.014)
<i>age</i>	2.473***	-0.000***	2.660***
	(0.483)	(0.000)	(0.483)
<i>lev</i>	63.671***	-0.033***	75.862***
	(13.732)	(0.002)	(13.812)
<i>rdi</i>			374.731***
			(53.847)
<i>_cons</i>	-1029.506***	0.153***	-1086.663***
	(59.661)	(0.011)	(60.089)
Industry fixed effect	control	control	control
Annual fixed effect	control	control	control
N	10439.000	10439.000	10439.000
R ²	0.063	0.211	0.068
adj. R ²	0.061	0.209	0.066

4.5. Robustness and Endogenous Test

The mixed OLS model is used to estimate the data as accurately as possible with fixed time and industry effect, but in order to ensure the robustness of the basic regression results, two ideas are further used to test the robustness of the model. The first idea is to add two controlled variables, ownership concentration and total assets turnover rate, to the model for analysis. The analysis results are basically consistent with the original model, so it can be considered that the model has certain robustness. The second idea is to replace the explained variables and conduct regression test again. Replace the measurement index of financial performance with return on equity (ROE), and the calculation method is $ROE = \text{after-tax profit} / \text{owner's equity} * 100\%$. At the same time, the innovation performance is replaced by the sum of the number of utility model patents and design patents. The results show that the influence of financial subsidy on business performance (including financial performance and innovation performance) is still significantly positive within 99% confidence interval, which further illustrates the reliability of the conclusion.

5. Conclusion and Enlightenment

5.1. Research Conclusion

This study takes the financial subsidy for high-tech enterprises as the starting point, and through empirical research on A-share high-tech listed companies from 2017 to 2021, examines the impact of financial subsidy on enterprise financial performance and innovation performance. It also opens up

the black box of the value-added effect of financial subsidy on enterprise operational performance through two mechanisms: R&D investment intensity and corporate market valuation.

First, financial subsidy can significantly improve business performance, so it is necessary to give financial subsidies to high-tech enterprises. Secondly, state-owned enterprises and non-state-owned enterprises can regulate the business performance of enterprises. The corporate nature of state-owned high-tech enterprises will significantly weaken the impact of financial subsidy on financial performance, but significantly enhance the impact on enterprise innovation performance. The nature of non-state-owned high-tech enterprises will enhance and weaken the impact of financial subsidies on financial performance, but significantly weaken the impact on innovation performance. Third, the scale of enterprises plays a regulatory role in the business performance of enterprises, which will significantly weaken the influence of financial subsidy on the financial performance and innovation performance of enterprises. The larger the scale of high-tech enterprises, the weaker the role of financial subsidy in promoting financial performance and innovation performance of enterprises; On the contrary, for smaller high-tech enterprises, financial subsidy can better promote their financial performance and innovation performance; Fourthly, the intensity of R&D investment plays an intermediary role in the business performance of enterprises. Within enterprises, financial subsidies as a policy signal can stimulate enterprises to increase the intensity of R&D investment, and then bring about the improvement of business performance. Finally, the market valuation of enterprises plays an intermediary role in their business performance. Outside the enterprise, financial subsidies as a policy signal can improve the market valuation of the enterprise by the society, and then improve the business performance of the enterprise.

5.2. Policy Advice

First of all, financial subsidy can indeed significantly improve the financial performance and innovation performance of high-tech enterprises. Therefore, it is necessary to provide financial subsidies to high-tech enterprises, and it is necessary to appropriately increase subsidies and amplify the incentive effect of financial subsidies as a policy signal.

Secondly, the soft budget constraint requires that financial subsidies should take into account enterprises of different ownership types, take into account the nature of different enterprises when choosing subsidies, and comprehensively consider the maximization of financial performance and innovation performance. If there is obvious ownership discrimination in financial subsidies to subsidize state-owned enterprises, it will not only improve innovation performance, but also bring low financial performance. However, it cannot be ignored that although financial subsidies to state-owned enterprises will inhibit financial performance in the short term, in the long run, the improvement of innovation performance will bring more dividends to the national strategic level. On the other hand, financial subsidies to non-state-owned enterprises will improve financial performance, but will inhibit the improvement of innovation performance.

Third, the diminishing returns to scale require that financial subsidies need to have a certain tendency, and it is necessary to "make up for both ends and make up for the middle". The results of this study reflect that high-tech enterprises have the characteristics of "uneconomical scale", but financial subsidies to large-scale high-tech enterprises have significantly inhibited their business performance. Therefore, when choosing the subsidy object, choosing the enterprises at both ends of the enterprise scale will bring more significant improvement in business performance. If it is to improve the financial performance of enterprises, small-scale enterprises can be selected for subsidies; If we focus on improving innovation performance, we can choose large-scale enterprises to subsidize.

Finally, pay attention to the transmission effect of internal and external signals of financial subsidies. As a policy signal, financial subsidies can not only affect the business performance of enterprises by internally affecting the R&D investment intensity, but also affect the market valuation of enterprises externally. It is necessary to improve the R&D investment intensity of enterprises through financial subsidies within enterprises, and also to improve the market valuation of enterprises through financial subsidies outside enterprises.

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