Frontiers in Economics and Management Volume 4 Issue 12, 2023
ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

Financial Subsidies, Life Cycle and Innovation Activities in Strategic Emerging Industries

Jia Li

School of Finance and Public Administration, Anhui University of Finance & Economics, Bengbu 233030, China

Abstract

This paper uses the data of listed companies in China's strategic emerging industries from 2010 to 2019 to empirically test the incentive effect of financial subsidies on innovation activities of strategic emerging enterprises from the perspective of enterprise life cycle. The results show that: on the whole, financial subsidies promote the improvement of total factor productivity of strategic emerging enterprises; From the perspective of different stages of enterprise development, financial subsidies have incentive effect on the innovation activities of enterprises in the growth stage, and this incentive effect has the most significant effect on enterprises in the mature stage, but has no effect on enterprises in the decline stage. Further subsample study reveals that financial subsidies significantly stimulate the innovation activities of non-state-owned enterprises and non-manufacturing enterprises, and the incentive effect has obvious regional heterogeneity; From the mechanism test, the growth of R&D expenditure of strategic emerging enterprises with financial subsidies is more obvious, which promotes the innovation activities of enterprises. After changing the explained variables and considering the endogeneity problem, the research conclusion of this paper is still robust. The research conclusion of this paper is helpful to optimize the allocation of fiscal and tax incentive policy funds and improve the efficiency of fiscal and tax incentive policy funds.

Keywords

Financial Subsidies; Life Cycle; Strategic Emerging Enterprises; Total Factor Productivity.

1. Introduction

In recent years, the Chinese economy has shifted from a stage of high-speed growth to a stage of high-quality development. There is an urgent need to shift the driving force of economic development and stimulate and release the internal vitality. In this context, the report of the 18th National Congress of the Party clearly put forward the "implementation of innovation-driven development strategy", and the report of the 19th National Congress further accelerated the construction of an innovative country as an important content of the construction of a modern economic system, and stressed that "innovation is the first driving force leading development". Under the new normal, China's economic take-off needs to realize the transformation from "made in China" to "innovative manufacturing in China", and the development of innovation capability of strategic emerging industries is the key to this transformation. The 14th Five-Year Plan emphasizes the importance and leading role of further implementing strategic emerging industries for the sustainable development of the national economy. The development of strategic emerging industries is an important decision to adjust the economic structure and seize the commanding heights of economic development, and it is an inevitable requirement for China to establish an innovative country, and strategic emerging industries to add new impetus for a new round of economic growth, scientific and technological innovation is the key. Under the new normal background of increasing downward pressure on

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

China's economic development, vigorously developing strategic emerging industries is not only an inevitable measure to enhance the core competitiveness of the industry and promote the transformation and upgrading of the industrial structure, but also a fundamental requirement to improve the comprehensive national strength and establish an innovative country. As an important incentive tool in fiscal and taxation policies, financial subsidies can not only directly affect the innovation activities of enterprises, but also have indirect effects on the innovation activities by affecting the innovation input and input structure. Therefore, it is of great theoretical significance to deeply explore the relationship between financial subsidies and innovation activities in strategic emerging industries.

Scholars have not reached a unanimous conclusion on whether financial subsidies are effective for independent innovation. Some scholars believe that financial subsidies can encourage enterprises to innovate independently. For example, Howell (2017) used the breakpoint regression method to study the implementation effect of the Small Business R&D Innovation Subsidy Program (SBIR) in the United States, and found that financial subsidies promoted the innovation output of enterprises, which was represented by the increase of high-quality patents and the growth of business income. Domestic scholars such as SDB et al. (2016) found that fiscal subsidies and tax incentives have a positive incentive effect on innovation investment in strategic emerging industries, but the incentive effect on R&D investment is better than that on human capital investment. Yao Linxiang and Leng Namin (2018) found that preferential tax policies not only significantly incentivize enterprise innovation, but also indirectly incentivize enterprise innovation by significantly increasing enterprise R&D funds and R&D personnel. Fiscal subsidy policies significantly inhibit enterprise innovation, but indirectly stimulate enterprise innovation by significantly increasing enterprise R&D funds. Wang Yanchao et al. (2019) found that measures such as tax incentives and financial subsidies are conducive to promoting and improving the level of enterprise innovation input, but their incentive effects are very different for enterprises in different industries and with different property rights. Tax incentives and financial subsidies have an obvious effect on promoting innovation in private enterprises, and the incentive effect is more significant for some tax-sensitive industries. However, some scholars believe that financial subsidies may inhibit enterprises' independent innovation. For example, Boeing (2016) studied the effect of R&D policy subsidies on Chinese enterprises from 2001 to 2006, and found that fiscal subsidies squeezed out R&D investment in the short term, but had no impact on enterprise R&D investment in the long run. Zhao Yulin and Gu Junjian (2018) believe that there is a structural deviation between the current government subsidy distribution tendency and innovation incentive, which has no incentive effect on enterprises' R&D investment on the whole. Yang Guochao et al. (2017) found that the "one-size-fits-all" micro-identification threshold of the ratio of R&D investment to sales revenue determined by the "High-tech Enterprise Identification Management Method" led companies to manipulate R&D behavior in order to obtain more tax incentives and financial subsidies, which ultimately led to the decline of the company's R&D performance.

To sum up, domestic and foreign scholars have conducted a large number of beneficial studies on the impact of fiscal policies such as fiscal subsidies and tax reduction and exemption on the innovation activities of strategic emerging industries. Some of them have separately studied the action path and effect of fiscal subsidies and tax incentives on the innovation activities of strategic emerging industries. There are also financial subsidies and tax incentives into a framework system to analyze the path of action and impact on the innovation activities of strategic emerging industries, but their impact effects are still controversial, and no unified conclusion has been drawn. Specifically, existing studies may have the following shortcomings: First, the existing researches mainly use enterprises' R&D expenditure input, human capital input and enterprise patent output to measure the innovation activities of strategic emerging industries. However, there are few literatures on the measurement of high-quality

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

development indicators of strategic emerging industries, and the literatures on the effects of fiscal policies such as financial subsidies and tax reduction on high-quality development of strategic emerging industries are even rare. Second, most of the existing studies are limited to evaluating the incentive effect of fiscal policies such as fiscal subsidies and tax reduction on the policy objectives of strategic emerging industries at a certain stage, so that it is difficult to explain whether the current fiscal and tax policies really effectively promote the high-quality development of strategic emerging industries. Based on this, the possible innovations of this paper are as follows: first, the total factor productivity of enterprises is taken as an index to measure the high-quality development of strategic emerging industries, the OP and LP methods are used to comprehensively measure the high-quality development status of China's strategic emerging industries, and on this basis, the effect of financial subsidies on the high-quality development of strategic emerging industries is empirically investigated. The second is a theoretical and empirical study on the impact of financial subsidies on the high-quality development of strategic emerging industries from the aspects of the enterprise's cycle stage, industry category, regional location, property structure and so on.

The following structure of this paper is arranged as follows: The second part, based on the life cycle theory, deeply analyzes the theoretical path of strategic emerging enterprises in different life cycle stages to the enterprise innovation activities when receiving financial subsidies; The third part introduces the empirical model and variable definition. The fourth part reports the results of empirical estimation, and carries out robust analysis from the dimensions of replacing explained variables and solving endogeneity. The fifth part empirically analyzes the mechanism and path of financial subsidies affecting the innovation activities of strategic emerging enterprises; The sixth part is the conclusion of this paper.

2. Theoretical Analysis

The uncertainty of innovation investment in strategic emerging industries, the risk of R&D process, the publicity of R&D results and the externality of product effects not only determine that strategic emerging industries have a greater demand dependence on government support, but also provide a theoretical basis for the government to use fiscal and tax incentive policies to support. In general, the main means for the government to support enterprises to engage in innovative activities include financial subsidies and other incentive policy tools. In order to provide more accurate and effective fiscal and tax incentive policies, improve the efficiency of policy operation and enhance the effect of policy support, it is necessary to systematically explain the mechanism of financial subsidies on the innovation activities of strategic emerging industries in theory.

Due to the different stages in the enterprise life cycle, there are significant differences in innovation ability, research and development needs, cash flow, financing constraints and other aspects of enterprises. Based on this, based on the life cycle theory, this paper deeply analyzes the theoretical path of strategic emerging enterprises in different life cycle stages when receiving financial subsidies. In order to facilitate the analysis, the enterprise life cycle is divided into three stages: growth period, maturity period and decline period.

Compared with mature enterprises, growth-stage enterprises generally have the following three characteristics: (1) Stronger internal and external financing constraints. Enterprises in the growth stage have not yet formed stable profits and lack sufficient internal financial support (Takamatsu et al., 2011); However, external fund providers tend to maintain a relatively cautious and wait-and-see attitude towards their investment due to its uncertainty (Huang Hongbin et al., 2016), which in turn restricts the external financing of growth-stage enterprises. (2) More capital expenditure needs. Growth stage enterprises have not entered the market for a long time, and the primary task of this stage is not to engage in high-risk R&D and innovation

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

activities, but to seek more to "gain a foothold" in the market. (3) Greater risk of R&D failure and lower willingness to innovate. Growth stage enterprises are not familiar with the market, lack of research and development experience and long-term accumulation of technology, coupled with the financing constraints mentioned above, the risk and cost of innovation failure faced by growth stage enterprises are significantly higher than that of mature stage enterprises. Financial subsidies can reduce the unit cost and research and development risk of enterprises' innovation activities, and then enhance the innovation performance of enterprises by enhancing their enthusiasm for innovation activities. From the perspective of spillover effect of innovation achievements, the innovation achievements of enterprises have a certain positive externality, which is usually easy to be copied and imitated by other enterprises, resulting in the decline of the expected return of innovation. At this time, if financial subsidies are adopted, they can not only reduce the marginal cost of innovation and increase the expected income of enterprises, but also further enhance the enthusiasm of enterprises to carry out innovation activities. From the perspective of risk compensation, enterprises need to invest a lot of human and material resources in innovation activities, but the investment output and return are highly uncertain. In order to avoid the possible losses caused by high risks, enterprises are bound to reduce innovation investment, and some even do not carry out innovation activities. At this time, if financial subsidies are adopted, they are equivalent to giving enterprises certain risk compensation and risk protection. From the perspective of enterprise financing: compared with other activities, innovation activities have the characteristics of larger investment, longer investment cycle and greater investment risk, and the capital scale of the enterprise itself may not be fully supported. In addition, because potential capital suppliers are not willing to bear high risks and invest in enterprise innovation activities, financial subsidies can reduce or solve the financing problem of enterprises to a certain extent. Based on the above analysis, this paper proposes hypothesis 1.

Hypothesis 1: In the growth stage of enterprises, financial subsidies can encourage innovation activities of strategic emerging enterprises.

When the enterprise enters the mature stage, the enterprise's financing situation, capital expenditure direction, innovation ability and willingness will have obvious changes. At this stage, the biggest features of corporate finance are stable profit level, rich surplus accumulation and abundant cash flow (Huang Hongbin et al., 2016), reduced business risk, easier to be favored by individual or institutional investors, and more smooth financing channels. In addition, in terms of expenditure, on the one hand, mature enterprises have basically completed the capital accumulation in the early stage, the investment in large-scale fixed assets has declined, and the capital expenditure of enterprises has decreased significantly. On the other hand, since the corresponding sales network has been basically completed, the non-productive costs such as business entertainment expenses, business publicity expenses, and start-up expenses incurred during the preparation period of the enterprise have also been significantly reduced. More importantly, through the accumulation of R & D experience in the growth period and the increasing familiarity with the product market, the risk of R & D in the mature period is greatly reduced; In order to further consolidate the market position and grab a larger market share, the innovation willingness of mature enterprises reaches a peak. Based on the above analysis, hypothesis 2 is proposed.

Hypothesis 2: In the mature stage of enterprises, financial subsidies have the most obvious incentive effect on the innovation activities of strategic emerging enterprises.

Entering the recession period, the sales of enterprises show a declining trend, and profits decline or even losses. Operating risks are rising, internal and external financing channels are blocked, financing is relatively difficult, and the funds that can be used for research and development investment are more tight; From the perspective of innovation ability, the technology and equipment of enterprises in the recession period are relatively backward, and

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

the efficiency of innovation and the ability to transform innovation output into new products are poor. On the other hand, enterprises in recession often face the risk of delisting because of profit loss. When enterprises obtain financial subsidies, due to the lack of government supervision, there is no complete supporting regulatory measures and performance evaluation, enterprises will get financial subsidies for other purposes, thereby crowding out enterprise research and development funds. Based on the above analysis, we propose hypothesis 3.

Hypothesis 3: In the stage of enterprise recession, the incentive effect of financial subsidies on the innovation activities of strategic emerging enterprises is not obvious.

3. Model Construction and Variable Description

3.1. Model Construction

In order to comprehensively investigate the impact of financial subsidies on innovation activities of strategic emerging industries, this paper intends to establish a two-way fixed effect model with total factor productivity of enterprises as the explained variable and financial subsidies obtained by enterprises as the core explanatory variable:

$$TFP_{it} = \alpha + \beta * Subsidy_{it} + \sum \gamma X_{it} + \mu_i + \omega_t + \varepsilon_{it} \quad (1)$$

Where, the subscript i represents the enterprise and t represents the year. TFP is the total factor productivity of the firm, Subsidy represents the financial subsidy received by the firm, and X is a series of control variables. Firm fixed effects are used to control unobservable specific effects at the firm level that do not change over time. Indicates the year fixed effect, used to control the common impact on all enterprises at the annual level. Is a random error term. In addition, in order to eliminate the influence of potential intra-group residual correlation and heteroscedasticity on the significance inference of the estimated coefficients, we cluster the regression standard error to the firm level.

3.2. Description of Variables

3.2.1. Total Factor Productivity (TFP)

The existing innovation performance measurement methods pay more attention to the quantity of innovation (R&D input, patent output, output efficiency, etc.), but ignore the quality of innovation. R&d investment is initial investment and has no inevitable connection with innovation quality. Considering that enterprises may "whitewash" R&D investment in order to obtain fiscal and tax policy subsidies, it is biased to use R&D investment as a measurement index of innovation performance. Patent output is only a kind of knowledge output, and there is still a big gap with the connotation of high-quality development. On the whole, the current innovation performance measurement indicators attach importance to the quantity of innovation but ignore the quality of innovation. At the same time, there is also the problem of focusing on front-end inputs (R&D inputs) and mid-end outputs (patents), while ignoring end-point economic performance. Based on this, this paper uses total factor productivity to measure the innovation activities of enterprises, in order to reflect the results of innovation activities more comprehensively.

There are many methods to estimate the total factor productivity of enterprises (such as least square method, fixed effect method, semi-parameter method and generalized moment estimation method). In view of the effective avoidance of simultaneity bias and sample selectivity bias by semi-parametric OP method and LP method, this study conducted a benchmark analysis of the total factor productivity level of enterprises estimated by LP method, and conducted a robustness test with the results estimated by OP method. Specifically, referring to the estimation method proposed by Hu Haifeng et al., the main business income is used to

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

measure the total output (Y), the total number of employees is used to measure the input of labor factors (L), the net fixed assets is used to measure the input of capital factors (K), and the cash paid for the purchase and construction of fixed assets, intangible assets and other long-term assets is used to measure the enterprise's current investment (I). Intermediate inputs (Mat) are measured using cash outgoes on purchases of goods and services. The specific calculation model is as follows:

$$\ln Y_{it} = \theta_0 + \theta_1 * \ln K_{it} + \theta_2 * \ln L_{it} + \theta_3 * \ln Mat_{it} + Ind_i + Year_t + \varphi_{it} \quad (2)$$

Where, i represents the enterprise, t represents the Year, Ind and year are the fixed effects of the controlled enterprise and year, and are random error terms. Formula (2) is regression, and the final model residual is the total factor productivity.

3.2.2. Subsidy

Considering that the government subsidies in the company's financial statements include part of the tax incentives received, Liu Guangqiang's (2016) experience is used for reference, and the value of the government subsidies enjoyed by the company in the current year after excluding the tax incentives received is taken as a logarithm to measure the financial subsidies. The tax benefit is measured by the logarithm of the "tax refund received" in the company's cash flow statement.

3.2.3. Enterprise Life Cycle

There are many standards to measure the life cycle stage of enterprises, which can be generally divided into three categories: univariate analysis (such as enterprise size and age, etc.), comprehensive financial indicators (Anthony and Ramesh, 1992) and cash flow model (Dickinson, 2011). Compared with the previous two, the cash flow model method uses the positive and negative combination of the net cash flows of operation, investment and financing to reflect the growth rate, profitability and business risk of enterprises in different life cycle stages, avoids making assumptions about the distribution of life cycle in different companies, and has lower subjectivity and stronger practical operability (Huang Hongbin et al., 2016; Tong Jinzhi et al., 2018). Therefore, this paper uses the cash flow model method to measure the enterprise life cycle (see Table 1), and divides listed companies into three stages: growth stage, maturity stage and decline stage.

Table 1. The combination of cash flow characteristics of enterprises in different life cycle stages

Cash flow	Growth period		Mature stage	Decline phase				
	Start-up stage	Growth phase	Mature stage	Decline phase	Decline phase	Decline phase	Phase-out period	Phase-out period
Net operating cash flow	-	+	+	-	+	+	-	-
Net investment cash flow	-	-	-	-	+	+	+	+
Net financing cash flow	+	+	-	-	+	-	+	-

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

3.2.4. Control Variables

In order to reduce the impact of missing variable bias and improve the efficiency of regression estimation, the following variables are introduced into the model with reference to relevant studies by Chu Deyin et al. (2016) and Tong Jinzhi et al. (2018) : (1) Firmage: expressed by logarithm of "year of observation - year of company establishment +1"; (2) Firmsize: expressed as the logarithm of the number of employees; (3) Return on equity (ROA) : net profit/net assets; (4) Leverage: total liabilities/total assets; (5) Liquidity: current assets/current liabilities.

3.3. Data Sources

This paper takes the A-shares listed in Shanghai and Shenzhen stock markets as the analysis object. As the China Securities Regulatory Commission has not yet classified strategic emerging industries, this paper takes the 1117 original sample stocks selected by China Strategic Emerging Industries Composite Index (hereinafter referred to as Emerging Composite Index) released by China Securities Index Co., LTD and Shanghai Stock Exchange on January 25, 2017 as the reference frame, and excludes the listed companies on the New Third Board and ST abnormal stocks. Companies with missing main indicator data and obvious data anomalies were deleted, and 430 enterprises were finally identified. Since The State Council issued the Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries in 2010 and considered excluding the impact of major health emergencies, the sample interval of this paper is from 2010 to 2019. Relevant data are from Guotai 'an database. Table 2 presents descriptive statistics for each variable.

Table 2. Descriptive statistical analysis

Variable	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
TFP	4300	17.226	1.028	14.336	20.875
Subsidy	3733	16.708	1.6	7.824	21.664
Firmage	4300	2.776	0.384	0.693	3.584
Firmsize	4300	7.909	1.175	3.367	12.444
ROA	4300	0.049	1.148	-66.535	18.081
Leverage	4300	0.419	0.205	0.015	2.003
Liquidity	4300	2.833	3.866	0.094	64.801

4. Empirical Results

4.1. Analysis of Benchmark Regression Results

In order to comprehensively investigate the impact of financial subsidies on the innovation activities of strategic emerging industries, this paper establishes a two-way fixed-effect model with firm total factor productivity as the explained variable and firm financial subsidies as the core explanatory variable. The empirical estimation results are shown in Table 3. Column (1) shows the estimated results of the incentive effect of financial subsidies on the innovation activities of the full sample of strategic emerging firms. The results show that the regression coefficient of financial subsidies on total factor productivity is 0.0484, which is significant at 1% significance level. In general, financial subsidies can stimulate the innovation activities of strategic emerging enterprises. Further, this paper examines the incentive effect of financial subsidies on innovation activities of enterprises in different life cycle stages. Columns (2) to (4) show regression results for different life cycle stages. For enterprises in the growth stage, the regression coefficients of financial subsidies on total factor productivity of enterprises are 0.0446, and are significant at 1% significance level. It shows that financial subsidies can promote the innovation behavior of enterprises in the growth stage. Hypothesis 1 is verified. For mature enterprises, the coefficient of financial subsidy is 0.0523, and it is significant at 5%

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

significance level. It shows that in the mature stage, financial subsidies encourage the innovation behavior of enterprises, and the incentive effect is more obvious than that in the growth stage. Hypothesis 2 is verified. For enterprises in recession period, the coefficient of financial subsidy is 0.0168 but not significant. It shows that financial subsidies do not effectively encourage the innovation behavior of enterprises in the stage of enterprise decline.

Table 3. Regression results of the benchmark model

	(1)	(2)	(3)	(4)
	Full sample	Growth period	Mature stage	Decline phase
Subsidy	0.0484*** (0.0127)	0.0446*** (0.0144)	0.0523** (0.0207)	0.0168 (0.0214)
Control variable	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Firm fixed effect	YES	YES	YES	YES
Constant term	13.68*** (0.402)	14.91*** (0.520)	12.18*** (0.629)	14.53*** (0.699)
N	3733	1844	1238	651
R^2	0.504	0.568	0.585	0.337

Note: City clustering robust standard error in parentheses; Control variables include Firmage, Firmsize, return on equity (ROA), Leverage and Liquidity. *, **, *** means passing the statistical significance test of 10%, 5%, and 1% respectively. The following table is the same.

4.2. Robustness Test

4.2.1. Replace the Explained Variable

In order to ensure that the regression results are not different with the different measurement methods of TFP, this paper takes the enterprise TFP level estimated by the OP method as the explained variable and conducts regression analysis on model (2) again. The estimated results are shown in Table 4. Column (1) shows that the coefficient of financial subsidies is 0.0631 and is significant at the 1% significance level. The financial subsidy coefficient shown in column (2) is 0.0538 and passes the T-test at the 1% significance level. The regression results in column (3) show that the coefficient of financial subsidies is 0.0659 and significant at the 1% significance level. Column (4) shows that the regression coefficient of financial subsidies is 0.033 but fails the significance test. As can be seen from the regression results in Table 4, whether it is full sample regression or regression at different life cycle stages, the financial subsidy coefficient and significance are consistent with the benchmark regression. It shows that the research conclusion of this paper is still valid.

Table 4. Robustness test 1-Change the explained variable

	(1)	(2)	(3)	(4)
	Full sample	Growth period	Mature stage	Decline phase
Subsidy	0.0631*** (0.0142)	0.0538*** (0.0168)	0.0659*** (0.0228)	0.0330 (0.0228)
Control variable	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Firm fixed effect	YES	YES	YES	YES
Constant term	16.17*** (0.419)	17.76*** (0.550)	14.69*** (0.679)	16.88*** (0.771)
N	3733	1844	1238	651
R^2	0.405	0.484	0.471	0.260

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

4.2.2. Endogeneity Problem

In order to overcome the potential two-way causal endogenous problem, and considering that there is a certain time lag between obtaining financial subsidies and making R&D investment, we treated financial subsidies as a one-stage lag and re-substituted them into model (2). The estimated results are shown in Table 5. From the regression results in Table 5, it can be found that after using the lagged term of financial subsidies for regression, the regression coefficient and significance of both the full sample enterprises and enterprises at different life cycle stages are basically consistent with the benchmark regression, indicating that the research conclusion in this paper is credible.

Table 5. Robustness Test 2-Endogeneity problem

	(1)	(2)	(3)	(4)
	Full sample	Growth period	Mature stage	Decline phase
Subsidy	0.0306***	0.0518***	0.0104	0.00747
	(0.0110)	(0.0166)	(0.0123)	(0.0183)
Control variable	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Firm fixed effect	YES	YES	YES	YES
Constant term	13.66***	13.92***	13.19***	14.90***
	(0.468)	(0.712)	(0.619)	(0.736)
N	3351	1619	1127	605
R^2	0.471	0.529	0.568	0.375

4.3. Heterogeneity Analysis

4.3.1. State-owned Enterprises and Non-state-owned Enterprises

Different ownership enterprises have great differences in natural endowment, internal operation and governance structure, which leads to different strategic behaviors in resource acquisition, signal transmission, principal-agent and so on. State-owned enterprises not only receive many financial subsidies, but also have other abundant access to resources. State-owned enterprises to receive financial subsidies in the investment market is considered to be repeated labeling, which triggers very limited marginal investment. Therefore, the incentive effect of state-owned enterprises receiving financial subsidies on innovation has limitations. On the contrary, due to the information asymmetry between enterprises and the market, it is urgent for the government to act as an information intermediary. Therefore, obtaining financial subsidies will bring greater marginal investment to non-state-owned enterprises. Based on this, this paper investigates the incentive effect of financial subsidies on enterprise innovation activities in different life cycle stages of state-owned enterprises and non-state-owned enterprises, and the regression results are shown in Table 6. In column (1), in the growth period, the regression coefficient of financial subsidies for non-state-owned enterprises is 0.0491 and significant at 5% significance level, while the regression coefficient of financial subsidies for state-owned enterprises is 0.0344 and significant at 5% significance level. Column (2) shows that in the mature stage, the regression coefficients of financial subsidies for non-state-owned enterprises and state-owned enterprises are 0.0564 and 0.0470, respectively, and both are significant at the 5% significance level. The regression results in column (3) show that in the recession period, the regression coefficients of financial subsidies of both non-state-owned enterprises and state-owned enterprises are not significant. As can be seen from the regression results in Table 6, compared with state-owned enterprises, the financial subsidies received by non-state-owned enterprises have a stronger incentive effect on enterprise innovation activities. From the perspective of different life cycle stages, giving fiscal and tax incentives to

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

mature non-state-owned enterprises is more conducive to stimulating the innovation activities of enterprises.

Table 6. Heterogeneity analysis 1-non-state-owned enterprises and state-owned enterprises

Panel A: Non-state-owned enterprises	(1)	(2)	(3)
	Growth period	Mature stage	Decline phase
Subsidy	0.0491** (0.0206)	0.0564** (0.0277)	-0.0173 (0.0282)
Control variable	YES	YES	YES
Year fixed effect	YES	YES	YES
Firm fixed effect	YES	YES	YES
Constant term	14.21*** (0.615)	11.10*** (0.734)	14.51*** (0.852)
N	1019	669	323
R^2	0.623	0.715	0.484
Panel B: State-owned enterprise	(1)	(2)	(3)
	Growth period	Mature stage	Decline phase
Subsidy	0.0344** (0.0174)	0.0470** (0.0207)	0.0412 (0.0310)
Control variable	YES	YES	YES
Year fixed effect	YES	YES	YES
Firm fixed effect	YES	YES	YES
Constant term	15.50*** (0.895)	14.79*** (0.974)	15.48*** (1.607)
N	825	569	328
R^2	0.506	0.379	0.212

4.3.2. Manufacturing and Non-manufacturing Industries

In the case of considering the particularity of the industry, the sensitivity of the research and development capacity of different industries to the tax burden is different. Some industries, such as information technology, logistics, wholesale and retail and manufacturing, themselves have a relatively high tax burden and are more sensitive to changes in tax burden. At the same time, these industries generally require a large amount of research and development investment. If the corresponding financial subsidies are given to these industries, they can reduce the cost and risk of their research and development expenditure, thereby stimulating the vitality of research and development and innovation in these industries. In other words, the incentive intensity of financial subsidies for special industries with high innovation sensitivity is greater than that of other industries. This paper divides the sample into two sub-samples, manufacturing and non-manufacturing, according to the "Guidelines on Industry Classification of Listed Companies" issued by China Securities Regulatory Commission in 2012. Based on the industry perspective, this paper examines the incentive effects of enterprise innovation displayed by different types of industries when obtaining financial subsidies. Table 7 provides sub-sample regression results of non-manufacturing enterprises and manufacturing enterprises. In column (1), the regression coefficient of financial subsidies for non-manufacturing enterprises is 0.0568 and is significant at 5% significance level, while the regression coefficient of financial subsidies for manufacturing enterprises is 0.032 and is significant at 5% significance level. The regression results in column (2) show that in the maturity period, the financial subsidy coefficient of non-manufacturing enterprises is 0.0677 and significant at the significance level of 5%, while the financial subsidy regression coefficient of manufacturing enterprises is 0.049 and significant at the significance level of 10%. In column

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

(3), the regression coefficient of financial subsidies for non-manufacturing enterprises is 0.0578, and is significant at the 5% significance level, while the regression coefficient of financial subsidies for manufacturing enterprises is negative and not significant. As can be seen from the regression results in Table 7, compared with the manufacturing industry, the financial subsidies obtained by non-manufacturing enterprises have a stronger incentive effect on the innovation activities of enterprises. From the perspective of different life cycle stages, the effect of fiscal and tax policies on non-manufacturing enterprises in mature stage is more obvious.

Table 7. Heterogeneity analysis 2-Non-manufacturing and manufacturing industries

Panel A: Non-manufacturing	(1)	(2)	(3)
	Growth period	Mature stage	Decline phase
Subsidy	0.0568** (0.0254)	0.0677** (0.0304)	0.0578** (0.0281)
Control variable	YES	YES	YES
Year fixed effect	YES	YES	YES
Firm fixed effect	YES	YES	YES
Constant term	14.72*** (0.895)	13.19*** (1.138)	13.18*** (1.384)
N	501	384	239
R^2	0.567	0.531	0.538
Panel B: Manufacturing	(1)	(2)	(3)
	Growth period	Mature stage	Decline phase
Subsidy	0.0320** (0.0151)	0.0490* (0.0254)	-0.00310 (0.0278)
Control variable	YES	YES	YES
Year fixed effect	YES	YES	YES
Firm fixed effect	YES	YES	YES
Constant term	14.34*** (0.531)	11.59*** (0.783)	14.97*** (0.742)
N	1343	854	412
R^2	0.605	0.652	0.207

4.3.3. Eastern and Central Regions

Due to the regional differences in China's economic development, the business environment, innovation atmosphere, financing constraints and other influencing factors faced by enterprises in different regions are different. Based on this, this paper investigates the incentive effect of financial subsidies on enterprise innovation activities in different life cycle stages of enterprises in the eastern region and enterprises in the central and western regions respectively, and the regression results are shown in Table 8. In column (1), the regression coefficient of financial subsidies for enterprises in the eastern region is 0.061, which is significant at 1% significance level, while the regression coefficient of financial subsidies for enterprises in the central and western regions is 0.0132, which is not significant, indicating that fiscal and tax policy incentives for enterprises in the growth stage in the eastern region may be more conducive to enterprise innovation activities. In column (2), the regression coefficient of financial subsidies for enterprises in the eastern region is 0.0526, and is significant at the 5% significance level, and the regression coefficient of financial subsidies for enterprises in the central and western region is 0.0578, and is significant at the 5% significance level. The regression results show that in the mature stage, although financial subsidies for enterprises in the eastern region and the central and western regions can stimulate enterprises' innovation behavior, the incentive effect on enterprises in the central and western regions is more obvious.

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

The regression results in column (3) show that the regression coefficient of financial subsidies is not significant for enterprises in the eastern region or the central and western region, indicating that financial subsidies have no incentive effect on the innovation behavior of enterprises in various regions during the recession stage.

Table 8. Heterogeneity analysis 3-Eastern region and Central and western region

Panel A: Eastern region	(1)	(2)	(3)
	Growth period	Mature stage	Decline phase
Subsidy	0.0610***	0.0526**	0.0168
	(0.0194)	(0.0255)	(0.0253)
Control variable	YES	YES	YES
Year fixed effect	YES	YES	YES
Firm fixed effect	YES	YES	YES
Constant term	14.56***	12.33***	14.19***
	(0.615)	(0.709)	(0.669)
N	1225	884	479
R^2	0.588	0.629	0.374
Panel B: Midwest region	(1)	(2)	(3)
	Growth period	Mature stage	Decline phase
Subsidy	0.0132	0.0578**	-0.00251
	(0.0180)	(0.0265)	(0.0322)
Control variable	YES	YES	YES
Year fixed effect	YES	YES	YES
Firm fixed effect	YES	YES	YES
Constant term	15.46***	11.79***	13.09***
	(0.913)	(1.053)	(3.508)
N	619	354	172
R^2	0.553	0.538	0.477

5. Mechanism Inspection

Table 9. Mechanism test

	(1)	(2)	(3)	(4)
	Full sample	Growth period	Mature stage	Decline phase
Subsidy	0.0575**	0.0563**	0.0129	-0.0000826
	(0.0260)	(0.0270)	(0.0378)	(0.0877)
Control variable	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Firm fixed effect	YES	YES	YES	YES
Constant term	12.62***	13.47***	12.78***	14.67***
	(0.739)	(0.773)	(1.381)	(1.440)
N	2029	1004	699	326
R^2	0.623	0.633	0.669	0.582

In order to more specifically analyze the impact of financial subsidies on enterprise innovation activities, based on the above theoretical analysis, financial subsidies not only directly affect enterprise innovation, but also indirectly affect enterprise innovation activities through leverage effect to leverage enterprises to increase R&D investment. Based on this, this paper

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

analyzes the effect of financial subsidies on R&D expenditure as the explained variable, and the regression results are shown in Table 9. Column (1) shows the incentive effect of financial subsidies received by the full sample enterprises on their R&D expenditures, and the regression coefficient of financial subsidies is 0.0575, which is significant at the 5% significance level. It shows that fiscal subsidies do promote the growth of R&D expenditure of strategic emerging enterprises, and then improve the total factor productivity of enterprises. Columns (2) to (4) respectively show the incentive effect of R&D expenditure of enterprises in different life cycle stages after obtaining financial subsidies. On the whole, strategic emerging enterprises in the growth stage have more obvious incentive effect on R&D expenditure after obtaining financial subsidies.

6. Conclusion

Scholars have not reached a unanimous conclusion on the effectiveness of financial subsidies on the innovation activities of strategic emerging enterprises. This paper tries to provide a new annotation based on the perspective of enterprise life cycle theory. Using the data of strategic emerging enterprises listed in Shanghai and Shenzhen from 2010 to 2019 as samples, this paper empirically tests the incentive effect of financial subsidies on the innovation activities of strategic emerging enterprises in different life cycle stages. The results show that: First, on the whole, financial subsidies promote the improvement of total factor productivity of strategic emerging enterprises. In other words, financial subsidies have incentive effect on innovation activities of strategic emerging enterprises; Second, from the perspective of different stages of enterprise development, the incentive effect of financial subsidies on the innovation activities of strategic emerging enterprises is obviously different. Specifically, financial subsidies have an incentive effect on the innovation activities of enterprises in the growth stage, and the incentive effect is most significant for enterprises in the mature stage, but has no effect on enterprises in the decline stage. Third, financial subsidies significantly stimulate the innovation activities of non-state-owned enterprises and non-manufacturing enterprises, and the incentive effect has obvious regional heterogeneity; Fourth, from the perspective of mechanism test, the growth of R&D expenditure of strategic emerging enterprises with financial subsidies is more obvious, which promotes the innovation activities of enterprises.

Acknowledgments

Supported by the Scientific Research Foundation of Anhui University of Finance and Economics (No. ACKYC21023).

References

[1] Howell S. T.. Financing Innovation: Evidence from R&D Grants[J]. American Economic Review, 2017, 107(4): 1136- 1164.

[2] Chu Deyin, Yang Shan, Song Genmiao. fiscal subsidies, tax incentives and innovation investment in strategic emerging industries[J]. Finance and Trade Research, 2016(5): 83-89.

[3] Yao Linxiang, Leng Nemin. Analysis of the incentive effect of fiscal and tax policies on the innovation efficiency of strategic emerging industries[J]. East China Economic Management, 2018(12): 94-100.

[4] Wang Yanchao, Li Ling, Wang Biaohua. Can tax incentives and fiscal subsidies effectively promote corporate innovation? -- An empirical study based on differences in ownership and industry characteristics[J]. Tax Research, 2019(6): 92-98.

[5] Boeing P.. The Allocation and Effectiveness of China's R&D Subsidies-Evidence from Listed Firms [J]. Research Policy, 2016, 45(9): 1774- 1789.

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0029

[6] Zhao Yulin, Gu Junjian. Structural bias of government subsidy allocation propensity and innovation incentives - an analysis based on a matched sample of Chinese listed manufacturing companies[J]. Fiscal Research, 2018(4): 61-74.

[7] Yang G. Chao, Liu J., Lian P., Rui M. Tax cut incentives, R&D manipulation and R&D performance[J]. Economic Research, 2017(8): 110-124.

[8] Gao Song, Zhuang Hui, Niu Panqiang. A study on the enhancement of government funding effect in science and technology-based SMEs: A life-cycle perspective [J]. China Industrial Economics, 2011(7): 150-158.

[9] Huang H-B, Zhai S-P, Chen J-N. Corporate life cycle, financing methods and financing constraints-A study based on the moderating effect of investor sentiment [J]. Financial Research, 2016 (7): 96-112.

[10] Hu, H. F., Dou, B., Wang, A. P.. Corporate financialization and productive efficiency [J]. World Economy, 2020, 43(01): 70-96.

[11] Liu Guangqiang. Analysis of incentive effects of tax incentives and fiscal subsidies policies - an empirical study based on the perspective of information asymmetry theory[J]. Management World, 2016(10): 62-71.

[12] Anthony J H, Ramesh K. Association between Accounting Performance Measures and Stock Prices: A Test of the Life Cycle Hypothesis [J]. Journal of Accounting and Economics, 1992, 15(2):203-227.

[13] Dickinson V. Cash Flow Patterns as a Proxy for Firm Life Cycle [J]. The Accounting Review, 2011, 86(6): 1969-1994.

[14] Tong Jinzhi, Liu Shiyuan, Lin Zhifan. fiscal subsidies, life cycle and corporate R&D innovation [J]. Fiscal Research, 2018(4): 33-47.