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Government Subsidies, Financial Structure and R&D investment: Evidence from Chinese SMEs

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Abstract

This paper studies the influence of government subsidies and financing structure on corporate R&D investments by using the empirical data of Chinese enterprises listed in SME board. The study finds that: 1) Internal financing has the greatest effect on R&D investments, followed by debt financing and equity financing. 2) Both government subsidies and corporate financing can significantly influence corporate R&D investments. 3) Government subsidies have a significant moderating effect on the relationship between corporate financing and R&D investments, that is, the more government subsidies the small and medium-sized enterprises receive, the more willing they are to invest funds from other financing channels into R&D activities. In the further sample test, it is also find that government subsidies have a greater effect on the promotion of R&D investments in non-state-owned enterprises than in state-owned enterprises.

Keywords

Government Subsidy, Internal Financing, Debt Financing, Equity Financing, R&D Investment

1. Introduction

Since Schumpeter (1912) proposed innovation theory, most economists have taken as a given that innovation is particularly important for the economic development. From the macroscopic view, innovation is essential for the sustained growth of national economy, and is the key to determine international status and competitiveness. From the microcosmic view, enterprises want to survive in the fierce market competition; it is necessary to innovate. In the past 20 years,

China's R&D expenditure has been rising, according to the "2017 National Science and Technology Investments Statistics Bulletin", in 2017, China's investments in research and development of a total of 1.7606 trillion yuan, increase 12.3% over the previous year, investments intensity is 2.13%. Although since 2014, R&D Investments intensity of China has been more than 2%, it is also far from the OECD countries average R&D investments intensity of 2.4%, the government and enterprises need to increase investments in R&D continually.

R&D requires constant investments of funds, but, the internal funds of small and medium-sized enterprises, which we use SMEs to represent in the following chapters, are insufficient and external funds are required. On the one hand, with small size and a few assets, most SMEs cannot meet the loan conditions of banks, they are difficult to obtain bank loans, or have a high cost for debt financing. On the other hand, there is a high listing threshold and long IPO cycle in China, the cost of equity financing is high too. Data shows that by the end of October 2018, the average queue time for listing is about 15 months, and the average cost exceeds 70 million yuan, lack of funds has become a prominent problem hindering the research and development of SMEs.

Technology and knowledge have the spillover characteristics of public goods, R&D activities will inevitably encounter market failure and underinvestment (Tassey, 2004) [1], therefore, government support is the key to influence the corporate R&D activities. Theoretically, there may be crowding out or motivating effects of government subsidies on corporate R&D investments. On the one hand, Government subsidies are classified as part of an enterprise's income, and can be directly invested in R&D activities to compensate for the lack of marginal returns in the private sector, alleviate the externalities of R&D activity, then have a stimulating effect on R&D investments (Weiming Jie *et al.* 2009) [2]. Also, according to signaling model, government support can send positive signals to the market, reduce the information asymmetry between enterprises and investors, reduce the cost of debt financing, promote enterprises to obtain more external financing, increase R&D activities. On the other hand, government subsidizes specific enterprises, which will promote the hitchhiking behavior of other enterprises in the same industry, and increase the cost of R&D activities, then crowding out some of the private R&D investments.

This paper uses the 2013-2017 panel data of SMEs in China to study, focusing on whether government subsidies will promote the R&D investments of SMEs? How government subsidies affect the relationship of corporate financial structure and R&D investments? And considering that the cost of obtaining funds is different between state-owned enterprises and non-state-owned enterprises, we further regard the property rights as an important factor in this study. This paper contributes to the existing study in the following two respects. First, we supplement the literature on government subsidy, financial structure and corporate R&D investment. Second, our finding provides theoretical support for government to formulate relevant policies.

The rest of this paper is organized as follows. Section 2 presents hypothesis development. Section 3 discusses the data and empirical model. Section 4 presents a discussion of main results. Section 5 concludes.

2. Literature Review and Hypotheses Development

In order to study the relationship between government subsidy, financing structure and R&D Investment, this paper first review the relevant literature, then analyze theoretical relationship between financing structure and R&D activities, and the theoretical relationship between government subsidies and R&D activities, finally, further consider the interaction effect of government subsidy and financing structure.

2.1. Financial Structure and R&D Investments

Pecking order theory holds that, in a market with asymmetric information but no friction, the cost of internal financing is lower than that of external financing, and equity financing will convey the negative information of the company's operation, therefore, when the company is financing, it will give priority to internal financing, followed by debt financing, and finally equity financing (Myers & Majluf, 1984) [3]. The investments behavior of an enterprise is limited by the cost of internal financing and external financing, therefore, internal financing is the main source of investments for R&D investments. Hall (2002) finds that small companies experience high costs of R&D capital, and there is a positive relationship between internal cash flow and R&D investments [4]. Himmelberg and Petersen (1994) find that internal financing is the main source of R&D investments of small high-tech enterprises [5]. Jie Zhang *et al.* (2012) find for China that the internal cash flow and registered capital are the main source of funding for SMEs' R&D investments [6]. Most of studies indicate that internal funds will promote R&D investments, while financing constraints will deter R&D investments. Based on this, this paper puts forward the following assumption:

H1: Internal financing has the greatest positive effect on R&D investments, followed by debt financing and equity financing.

2.2. Government Subsidies and R&D Investments

The impact of government subsidies on R&D has been the focus of academic debate, based on the theory of State intervention, most scholars argue that government should properly intervene the market, improve the effective demand for R&D activities in the private sector. However, some scholars believe that government subsidies have substitution effect and crowding out effect on R&D investments. Also there are some scholars believe that the motivation effect and crowding out effect coexist.

Because of the positive externality of R&D activities, marginal returns from private R&D investments are lower than the marginal benefits from social R&D investments, therefore, it will appears to market failures if relying solely on

business investments (Arrow, 1962) [7]. So we need government departments to give redress and remedy by financial subsidies, and government subsidies have a significant stimulating effect on corporate R&D investments (Weimin Jie, 2009). There is a large literature that establishes that government subsidies can motivate enterprises to invest in R&D activities (Hamberg, 1966; Scott, 1984). The higher the technical level of the industry, or the larger the scale of enterprises, the worse the incentive effect of government subsidies on corporate R&D activities (Lach, 2002) [8]. There is also some literatures believe that, government subsidies for specific businesses will create free rider problems, and raise the price of relative factors, then crowding out parts of the private R&D investments (Shrieves, 1978; Lichtenberg, 1984) [9] [10]. Zheng (2009) based on a study of China's high-tech industry, find that government R&D activities will replace or crowd out some of the private R&D activities, and will weaken the incentive effect of fiscal policy [11]. A few studies show that, in China, the motivation effect and the crowding out effect of government subsidies coexist, and within a certain range, the motivation effect of government subsidies exceeds the crowding out effect (Gorg and Strobl, 2006) [12]. Based on this, this paper makes the following assumptions:

H2a: Government subsidies have stimulating effect on R&D investments of SMEs;

H2b: Government subsidies have crowding out effect on R&D investments of SMEs.

2.3. Government Subsidies, Financial Structure and R&D Investment

Due to the high uncertainty of innovation, information asymmetry exists between R&D activities and external investors. Government subsidies make efforts on complementing internal cash flows, alternatively they can also delivery positive signals to the market, eliminate information asymmetry in some way, then more external capitals invest in enterprises' R&D activities (Zhiyong Kang, 2013) [13]. Czarnitzki (2006) finds that, because of the high amount of government subsidies, the R&D investments of East German firms is not sensitive to the external financing constraints, by using Tobit model [14]. Xiaofang Bi (2017) suggests that government subsidy and financial redundancy can significantly stimulate the investments of firms' R&D, and they a complementary effect [15]. Based on this, this paper makes the following assumption:

H3: The more the government subsidies companies received, the more willing they are to invest the money from other financing channels into R&D activities.

To summarize, researches about the influence of government subsidy on enterprise innovation have produced abundant theoretical and empirical results, but because of the different methods or samples used, there is not yet a unified conclusion, and researches about the impact of financial structure on R&D investments are rich. However, there are only few studies combine these two factors, and deeply explore the specific links between government subsidies, finan-

cial structure and R&D investments. In view of this, this paper will combine two factors of government subsidy and financial structure, discuss how government subsidies affect the financial structure, thus further affecting R&D investments.

3. Data and Methodology

3.1. Sample Construction

In this paper, we use the annual financial data of firms listed in SME board from 2013 to 2017 as the initial sample, on the basis of the initial sample, the following processing is done: 1) We removed ST or *ST companies; 2) Eliminated observations with incomplete data; 3) Winsorized main variables. The final sample is 3570 observations of 714 companies listed in SME board, the data mainly from the wind database, processing with Stata.

3.2. Variable Construction

This paper mainly studies the influence of government subsidy and financing structure on the R&D investment of SMEs, therefore, the dependent variable of this paper is the R&D investments, which is measured by R&D investments divided by total assets. The main independent variables are government subsidy and internal and external financing, in this paper we measure government subsidy (Sub) as current government subsidies of SMEs in financial statement. We uses the net cash flow of business activities to measure internal financing, and debt financing (DF) is measured by short term loan plus long term loan and payable bonds, equity financing is measured by issued capital plus capital reserve.

Taking into account common method in this area, this article also adds variables that may have a significant impact on R&D activities as control variables: enterprise size (Size), enterprise age (Age), equity concentration (Con), profitability (Roe), leverage ratio (LEV), year virtual variable (years) and industry virtual variable (Ind). Details are provided in Table 1.

3.3. Models

Because the dependent variable is the R&D investments, but some R&D investments of SMEs are 0, there is a problem of 0 points deletion, therefore, this paper uses Tobit model to study the impact of government subsidy and financing structure on enterprises' R&D investment, model 1 and model 2 used to test hypothesis 1 and hypothesis 2, then, in order to study the interaction between government subsidy and enterprise financing structure, so we add interaction items into model 2, and we build model 3 to test hypothesis 3, we the model as follows:

Model 1:

$$\text{R\&D}_{it} = \beta_0 + \beta_1 \text{IF}_{it} + \beta_2 \text{Debt}_{it} + \beta_3 \text{Equity}_{it} + \beta_4 Z_{it} + \varepsilon$$

Model 2:

$$\text{R\&D}_{it} = \beta_0 + \beta_1 \text{Sub}_{it} + \beta_2 \text{IF}_{it} + \beta_3 \text{Debt}_{it} + \beta_4 \text{Equity}_{it} + \beta_5 Z_{it} + \varepsilon$$

Table 1. Variable definitions and calculations.

Symbol	Meaning	Calculation
R&D	R&D investments	R&D expenditures/total assets
Sub	Government subsidy	Government subsidies/total assets
IF	Internal financing	Net operating cash flow/total assets
Debt	Debt financing	(Long term loans+ short term loans + payable bonds)/total assets
Equity	Equity financing	(issued capital + capital reserve)/total assets
Size	Enterprise size	Ln(total assets at the beginning)
Age	Enterprise age	Years between financial reporting year and established year
Con	Equity concentration	Shareholding ratio of the largest shareholder
Roe	Profitability	Net income/average total assets
Lev	Leverage ratio	Total liabilities/total assets
Year	Year dummy	5 annual dummy variables
Ind	Industry dummy	14 industry dummy variables in the specific classification

Model 3a:

$$R\&D_{it} = \beta_0 + \beta_1 Sub + \beta_2 IF_{it} + \beta_3 Debt_{it} + \beta_4 Equity_{it} + \beta_5 Sub_{it} \times IF_{it} + \beta_6 Z_{it} + \varepsilon$$

Model 3b:

$$R\&D_{it} = \beta_0 + \beta_1 Sub + \beta_2 IF_{it} + \beta_3 Debt_{it} + \beta_4 Equity_{it} + \beta_5 Sub_{it} \times Debt_{it} + \beta_6 Z_{it} + \varepsilon$$

Model 3c:

$$R\&D_{it} = \beta_0 + \beta_1 Sub + \beta_2 IF_{it} + \beta_3 Debt_{it} + \beta_4 Equity_{it} + \beta_5 Sub_{it} \times Equity_{it} + \beta_6 Z_{it} + \varepsilon$$

where,

$$Z_{it} = \alpha_1 Size_{it} + \alpha_2 Age_{it} + \alpha_3 Con_{it} + \alpha_4 Roe_{it} + \alpha_5 Lev_{it} + \sum_k \alpha_k Year_k + \sum_j \alpha_j Ind_j$$

3.4. Descriptive Statistics of Variables

Following analysis is based on the balanced sample, which tracks the same firms over 5 years. Table 2 reports the means and standard deviations of main variables. The mean of R&D investments relative to total assets is 2.28%, and minimum value is 0, maximum value is 16.21%, which Indicates that the R&D investments of most SMEs are at a low level. The mean of debt financing is lower than internal financing and equity financing, but standard deviation of debt financing is the highest, this may be due to the fact that, the SMEs have many obstacles to obtain the credit support, such as lacking collateral. The values of the main variables are within a reasonable range, so the regression results are less affected by outliers.

4. Empirical Results

4.1. Government Subsidies, Financial Structure and R&D Investments of SMEs

This paper first studies the impact of government subsidies on R&D Investments,

Table 2. The description of the main variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
R&D	3570	0.0228	0.0237	0	0.1621
Sub	3570	0.0059	0.0072	0	0.0551
IF	3570	0.0559	0.0860	−0.3092	0.4085
Debt	3570	0.0347	0.1119	−0.2432	0.6771
Equity	3570	0.0942	0.2846	−0.0691	2.5578
Size	3570	21.7014	0.8645	18.9999	25.7005
Age	3570	16.4893	4.4208	6	36
Con	3570	0.3368	0.1453	0.0415	0.9336
ROE	3570	0.0710	0.0985	−0.4484	0.4325
LEV	3570	0.3808	0.1847	0.0359	0.9249

The result in the first column of Table 3 shows that, the regression coefficients of internal financing, debt financing and equity financing are significantly positive at 1% confidence level without taking into account of government subsidies, indicating that internal financing, debt financing and equity financing all have positive effects on innovation investments of SMEs, and The regression coefficient of internal financing is greater than that of debt financing and equity financing, which means that R&D investment is more sensitive to internal financing than debt financing and equity financing, China's SMEs tend to give priority to the use of internal funds for R&D activities, followed by debt financing, and finally equity financing, hypothesis 1 is verified. Then we studies the impact of government subsidies on R&D investments under the condition that financing structure remains unchanged, in the second column of Table 3, we add the variable of government subsidy, the result shows that both the government subsidy and the enterprise's internal and external financing variable regression coefficient are significantly positive at 1% confidence level, therefore, government subsidies can significantly stimulate the R&D investments of enterprises, and confirmed hypothesis 2a.

Through the above analysis, this paper has found that different financing methods have a positive impact on the innovation activities of enterprises, and then, this paper further studies the interaction between government subsidies and different financing methods. In columns 3, 4 and 5 of Table 3, the regression coefficients of the interaction items are significantly positive, indicating that the government subsidy has a significant positive moderating effect to the relationship of financing and R&D investment, hypothesis3 is established.

4.2. Regression Results of State-Owned and Non-State-Owned Enterprises

Considering that there are obvious differences in access to financial resources and government supports between enterprises of different ownership, it's necessary

Table 3. The effect of government subsidy and financial structure on R&D investment.

	Model 1	Model 2	Model 3a	Model 3b	Model 3c
Sub		0.2159***	0.0865	0.1101**	0.0631
		(0.0490)	(0.0557)	(0.0511)	(0.0521)
IF	0.0248***	0.0245***	0.0121**	0.0237***	0.0236***
	(0.0043)	(0.0043)	(0.0050)	(0.0043)	(0.0042)
Debt	0.0223***	0.0218***	0.0215***	0.0093***	0.0207***
	(0.0029)	(0.0029)	(0.0029)	(0.0034)	(0.0029)
Equity	0.0099***	0.0092***	0.0088***	0.0084***	0.0032**
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0013)
Size	−0.2398***	−0.2021***	−0.2101***	−0.1756**	−0.1692**
	(0.0766)	(0.0765)	(0.0765)	(0.0762)	(0.0760)
Age	0.0113	0.0112	0.0110	0.0116	0.0125
	(0.0186)	(0.0184)	(0.0184)	(0.0184)	(0.0184)
Con	−0.0117***	−0.0118***	−0.0118***	−0.0110***	−0.0118***
	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Roe	0.0193***	0.0166***	0.0150***	0.0162***	0.0160***
	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0039)
Lev	0.0006	0.00002	−0.0008	−0.0005	−0.0015
	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
Sub*IF			0.0152***		
			(0.0031)		
Sub*Debt				0.0151***	
				(0.0022)	
Sub*Equity					0.0052***
					(0.0006)
cons	6.6183***	5.7405***	6.0936***	5.1437***	5.1374**
	(2.0603)	(2.0562)	(2.0545)	(2.0438)	(2.0382)
Year	yes	yes	yes	yes	yes
Ind	yes	yes	yes	yes	yes
N	3570	3570	3570	3570	3570
Wald chi2	824.29	848.06	876.74	904.58	927.09
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: Standard errors in parentheses and aren't robust standard errors; *10% significance level; **5% significance level; ***1% significance level.

to test the influence of government subsidy and financing structure on the R&D investment of different ownership enterprises. In order to test the hypothsis3, Table 4 divides the samples into two groups, state and non-state. From the return results of state-owned enterprises and non-state-owned enterprises, for non-state-owned enterprises, the regression coefficients of Sub*IF, Sub*Debt and Sub*Equity, are significantly positive, which shows that government subsidy has obvious stimulating effect on the innovation financing of non-state-owned enterprises, that is, the greater the government subsides, the more the SMEs are willing to invest in R&D activities. For state-owned enterprises, the regression coefficient of interaction between government subsidy and internal financing is not significantly negative, indicating that the more the government subsidies,

Table 4. Regression results of state-owned and non-state-owned enterprises.

	State-owned (3a)	Non-state-owned (3a)	State-owned (3b)	Non-state-owned (3b)	State-owned (3c)	Non-state-owned (3c)
Sub	0.1568 (0.1568)	0.0661 (0.0593)	0.1003 (0.1354)	0.1003* (0.0551)	0.0392 (0.1434)	0.0562 (0.0559)
IF	0.0632*** (0.0185)	0.0064 (0.0051)	0.0592*** (0.0155)	0.0201*** (0.0044)	0.0587*** (0.0156)	0.0200*** (0.0044)
Debt	0.0079 (0.0106)	0.0233*** (0.0030)	−0.0129 (0.0144)	0.0111*** (0.0035)	0.0091 (0.0106)	0.0224*** (0.0030)
Equity	0.0155*** (0.0054)	0.0085*** (0.0011)	0.0151*** (0.0054)	0.0082*** (0.0011)	0.0071 (0.0076)	0.0031** (0.0013)
Size	0.2067 (0.2740)	−0.2300*** (0.0789)	0.2339 (0.2721)	−0.1930** (0.0787)	0.2250 (0.2733)	−0.1859** (0.0785)
Age	−0.0107 (0.0640)	0.0223 (0.0192)	−0.0123 (0.0635)	0.0216 (0.0191)	−0.0120 (0.0640)	0.0230 (0.0191)
Con	−0.0365** (0.0148)	−0.0106** (0.0042)	−0.0351** (0.0147)	−0.0098** (0.0041)	−0.0375** (0.0148)	−0.0106*** (0.0041)
Roe	0.0056 (0.0129)	0.0161*** (0.0042)	0.0044 (0.0128)	0.0180*** (0.0042)	0.0065 (0.0128)	0.0176*** (0.0042)
Lev	0.0026 (0.0112)	−0.0014 (0.0032)	0.0016 (0.0111)	−0.0008 (0.0032)	0.0019 (0.0112)	−0.0019 (0.0032)
Sub*IF	−0.0066 (0.0159)	0.0175*** (0.0032)				
Sub*Debt			0.0355** (0.0166)	0.0147*** (0.0022)		
Sub*Equity					0.0058 (0.0038)	0.0051*** (0.006)
cons	−16.8989	7.3765***	−17.6938	6.3451***	−16.6357	6.3239***
Year	yes	yes	yes	yes	yes	yes
Ind	yes	yes	yes	yes	yes	yes
N	510	3060	510	3060	510	3060
Wald chi2	174.33	769.65	180.06	786.07	177.23	809.25
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: Standard errors in parentheses; *10% significance level; **5% significance level; ***1% significance level.

the less willing the enterprises are to invest internal funds in R&D activities, the coefficient of interaction between government subsidy and debt financing is significantly positive, indicating that government subsidies can promote more debt financing for R&D activities. The difference may be that, the Chinese government, in constructing the financial system, gives more care to state-owned enterprises on the basis of ideological considerations, forming a resource allocation of discrimination against non-state-owned enterprises. The biased financial support of the financial system to state-owned enterprises leads to the more serious shortage of funds for the R&D investments of non-state-owned enterprises.

4.3. Robustness Tests

In order to test the robustness of research conclusions, firstly, we uses the fixed

effect model and the random effect model to estimate the impact of government subsidy and financial structure on R&D investment, Table 5 shows the empirical results of fixed effects model. Table 6 shows the empirical results of random effects model. As we can see from the following tables, the regression coefficients of internal financing, debt financing and equity financing are still significantly positive, and government subsidies have a significant positive moderating effect to the relationship of financing and R&D investments, the conclusions has not been greatly affected, so our main conclusions remain valid.

Secondly, there may be endogenous problems between government subsidies and R&D investments. On the one hand, government subsidies can affect R&D investments, and on the other hand, corporate innovation will in turn influence government subsidies (Lichtenberg, 1988). Therefore, we use different variables

Table 5. Results of fixed effects model.

	R&D	R&D	R&D	R&D	R&D
Sub		0.1537* (0.0824)	0.0110 (0.0941)	0.0527 (0.0830)	0.0024 (0.0809)
IF	0.0178*** (0.0058)	0.0177*** (0.0058)	0.0034 (0.0059)	0.0171*** (0.0056)	0.0167*** (0.0054)
Debt	0.0164*** (0.0040)	0.0161*** (0.0039)	0.0159*** (0.0038)	0.0046 (0.0039)	0.0155*** (0.0037)
Equity	0.0097*** (0.0019)	0.0092*** (0.0019)	0.0087*** (0.0016)	0.0086*** (0.0018)	0.0033* (0.0017)
Size	−0.4203** (0.1779)	−0.3872** (0.1804)	−0.4133* (0.1847)	−0.3413* (0.1853)	−0.3363* (0.1814)
Age	0.2079*** (0.0335)	0.2055*** (0.0339)	0.2065*** (0.0345)	0.2020*** (0.0342)	0.2005*** (0.0329)
Con	−0.0141 (0.0092)	−0.0145 (0.0092)	−0.0142 (0.0088)	−0.0125 (0.0092)	−0.0137 (0.0086)
Roe	0.0160*** (0.0048)	0.0139*** (0.0044)	0.0083*** (0.0047)	0.0136*** (0.0044)	0.0134*** (0.0043)
Lev	0.0099* (0.0051)	0.0095* (0.0051)	−0.0083* (0.0047)	−0.0085 (0.0052)	−0.0072 (0.0049)
Sub*IF			0.0175** (0.0076)		
Sub*Debt				0.0147*** (0.0047)	
Sub*Equity					0.0053*** (0.0015)
cons	7.6253** (3.4886)	6.9036* (3.5244)	7.6068** (3.5774)	6.0128* (3.6112)	6.0518* (3.5463)
Individual effect	Control	Control	Control	Control	Control
Time effect	Control	Control	Control	Control	Control
N	3570	3570	3570	3570	3570
F	13.7	12.97	13.47	13.51	13.98
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000

Table 6. Results of random effects model.

	R&D	R&D	R&D	R&D	R&D
Sub		0.2213*** (0.0410)	0.0859* (0.0460)	0.1188*** (0.0425)	0.0742* (0.0431)
IF	0.0239*** (0.0035)	0.0237*** (0.0035)	0.0102** (0.0041)	0.0229*** (0.0034)	0.0226*** (0.0035)
Debt	0.0196*** (0.0024)	0.0192*** (0.0024)	0.0189*** (0.0024)	0.0074*** (0.0028)	0.0184*** (0.0023)
Equity	0.0105*** (0.0009)	0.0098*** (0.0009)	0.0093*** (0.0009)	0.0092*** (0.0009)	0.0040*** (0.0011)
Size	−0.0930** (0.0592)	−0.0575 (0.0592)	−0.0724 (0.0591)	−0.0322 (0.0589)	−0.0355 (0.0586)
Age	0.1002*** (0.0137)	0.0983*** (0.0136)	0.0984*** (0.0136)	0.0980*** (0.0135)	0.0983*** (0.0135)
Con	−0.0186 (0.0035)	−0.0188*** (0.0035)	−0.0185*** (0.0035)	−0.0177*** (0.0035)	−0.0185*** (0.0035)
Roe	0.0174*** (0.0032)	0.0146*** (0.0033)	0.0129*** (0.0032)	0.0143*** (0.0032)	0.0139*** (0.0032)
Lev	0.0023* (0.0026)	0.0016 (0.0026)	0.0008 (0.0026)	0.0008 (0.0026)	0.00001 (0.0026)
Sub*IF			0.0165*** (0.0026)		
Sub*Debt				0.0149*** (0.0018)	
Sub*Equity					0.0052*** (0.0005)
cons	2.7661** (1.2036)	1.9582 (1.2057)	2.4048** (1.2040)	1.4805 (1.1980)	1.6421 (1.1947)
N	3570	3570	3570	3570	3570
LR chi2	515.62	544.70	584.00	610.25	636.20
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

to further test the impact of government subsidies and financing structure on enterprise R&D investments, using the same method as Huidong Li *et al.* (2013) [16], we use the registered city and ownership as agent variables of government subsidies, if the company is registered in prosperous cities, the government has more ability to provide subsidies to enterprises, at the same time, enterprises in these places have easier access to external resources, in addition, there is no direct relationship between the registered place of enterprises and the R&D investments. Then we use the Heckman two stage regression, Table 7 shows the results, the conclusions are still hold.

5. Conclusions

In recent years, the intensity of China's R&D investments is rising, but there is still a gap with the world level, because the capital market is not perfect, China's small and medium-sized enterprises innovation financing channels blocked,

Table 7. Results of Heckman two step regression.

	R&D	R&D	R&D	R&D
Sub	0.4513***	0.4239***	0.0284***	0.4994***
	(0.0494)	(0.0564)	(0.0048)	(0.0714)
IF	0.0259***	0.0223***	0.0284***	0.0244***
	(0.0045)	(0.0054)	(0.0048)	(0.0059)
Debt	0.0172***	0.0172***	0.0059	0.0201***
	(0.0033)	(0.0033)	(0.0040)	(0.0042)
Equity	0.0046***	0.0046***	0.0035**	−0.0047**
	(0.0012)	(0.0013)	(0.0014)	(0.0019)
Size	0.0089	0.0086	0.0277	−0.0090
	(0.0499)	(0.0498)	(0.0529)	(0.0657)
Age	0.0175**	0.0176**	0.0213**	0.0194*
	(0.0084)	(0.0084)	(0.0090)	(0.0111)
Con	−0.0076***	−0.0075***	−0.0047*	−0.0109***
	(0.0024)	(0.0024)	(0.0027)	0.0033
Roe	0.0319***	0.0318***	0.0308***	0.0413***
	(0.0041)	(0.0041)	(0.0042)	(0.0055)
Lev	−0.0029	−0.0031	−0.0016	−0.0047
	(0.0024)	(0.0024)	(0.0026)	(0.0033)
Sub*IF		0.0039		
		(0.0035)		
Sub*Debt			0.0141***	
			(0.0026)	
Sub*Equity				0.0038***
				(0.0009)
cons	0.5698	0.5759	−0.0193	1.67674
	(1.4733)	(1.4731)	(1.5219)	(1.8581)
N	3570	3570	3570	3570
LR chi2	939.78	934.86	958.15	838.75
Prob > chi2	0.0000	0.0000	0.0000	0.0000

government subsidies as an important source of enterprise innovation Investments, can alleviate the financing difficulty of enterprise innovation activities, and stimulate enterprises to invest in innovation. Based on the theory of government intervention and the theory of optimal order financing, this paper uses the empirical data of Chinese small listed companies from 2013 to 2017, discusses the relationship between government subsidy, financing structure and SMEs' R&D investments. The study finds that: 1) Both internal financing and external financing have positive effect on the R&D investments of SMEs, among which the effect of internal financing is the greatest, followed by debt financing and equity financing. 2) Government subsidies and corporate financing all can significantly influence the R&D investments of enterprises. 3) Government subsidies have a significant positive moderating effect to the relationship of financing and R&D investments, and government subsidies can release positive signals, then enable enterprises to obtain more external financing for their R&D activities.

R&D activities of SMEs in China are faced with the problem of insufficient capital and external financing channels. Government support and financial system reform are effective ways to alleviate the financing difficulties and promote investments in innovation of small company. The research in this paper shows that government subsidy has a significant positive moderating and, it can effectively alleviate the problem of insufficient innovation funds, and then promote the development of small and medium-sized enterprises. The government should strengthen financial support for R&D activities of SMEs, deepen financial system reform, eliminate discrimination in financial markets, and realize the effective allocation of financial resources, improve financing environment for SMEs innovation, and encourage SMEs to play a leading role in technological innovation.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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