



Research on the effect of financial subsidies on firm performance: Based on the mediating effect of R&D investment

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Abstract. In recent years, small and medium-sized enterprises have made important contributions to promoting economic development. As a favorable measure for the government to encourage innovation, financial subsidies are of great significance to ease the financing difficulties of enterprises. The data of manufacturing enterprises in GEM from 2017 to 2022 were selected as samples to analyze the relationship between fiscal and tax policies, R&D investment and enterprise performance. The results show that financial subsidies have positive incentive effect on R&D investment; R&d investment has a significant positive effect on firm performance. R&d investment has a partial mediating effect between financial subsidies and innovation performance.

Keywords: Financial subsidy; Enterprise performance; Research and development investment; Mediating effect

1 Introduction

The government encourages enterprises to carry out independent innovation through financial subsidies. Financial subsidies are non-repayable funds provided by the government to enterprises or private individuals that meet policy requirements, which can help the government achieve certain specific policy objectives, and help taxpayers reduce the burden of R & D innovation, increase their profit margins, and stimulate innovation vitality. At present, China's financial support for all kinds of enterprises is relatively strong, so this paper selects GEM manufacturing enterprises as the research object, analyzes the relationship between financial subsidies, R&D investment and enterprise performance, and provides empirical evidence.

2 Theoretical analysis and research hypothesis

2.1 Financial subsidies

Financial subsidies are a fiscal and tax policy of the government to encourage innovation. In terms of timing, financial subsidies provide certain funds for enterprises before research and development projects. In the form of financial subsidies, the enterprises do not need to repay the direct cash subsidies; In terms of intensity, financial subsidies help enterprises reduce research and development costs. Zhang Honggang (2014) ^[1] believes that financial subsidies are non-refundable financial subsidies granted by the government to guide the development of an industry, thus encouraging enterprises to carry out innovative production.

2.2 The relationship between financial subsidies and enterprise performance

The direct impact of financial subsidies on enterprise performance is mainly reflected in that subsidies provided by the government affect the financial statements of enterprises, and then increase the performance of enterprises. The indirect impact of financial subsidies on enterprise performance is mainly manifested in that government subsidies improve the capital level of enterprises, and enterprises make full use of R & D funds to promote enterprise performance. Most scholars believe that financial subsidies have a significant role in promoting enterprise performance. Paunov (2012) ^[2], Foreman-Peck et al. (2012) ^[3] and Heung-guk Han et al. (2020) ^[4] analyzed the impact of financial support on enterprise performance and found that financial support provided by the government improved enterprise performance. Based on this, the following hypothesis is proposed:

H1: Fiscal subsidy policy has a significant promoting effect on enterprise performance.

2.3 Financial subsidies and R&D investment

Financial subsidies are a means for the government to regulate the market, which can make up for the unearned benefits of enterprise R & D, and also encourage enterprises to increase investment in R & D innovation and promote technological innovation. Domestic and foreign scholars believe that financial subsidies can promote R&D investment. Based on the fixed-effect model, Wei Shuyu and Xiao Peng (2021) ^[5] found that financial subsidies can significantly promote enterprises to increase R&D investment. Hu Huifang, Ou Zhonghui and Tang Tongtong (2022) ^[6] used grey correlation analysis and regression analysis methods to study and found that government subsidies promoted the R&D activities of enterprises, drove the increase of R&D investment, and obtained more patent achievements. Based on the above views, this paper proposes the following hypotheses:

H2: Financial subsidies have a significant promoting effect on R&D investment of enterprises.

2.4 R&D investment and enterprise performance

Many scholars have studied the relationship between innovation activities and current corporate performance. Luo Jianqiang et al. (2023) ^[7] combined service-oriented theory with innovation theory and found that R&D innovation input of technology-intensive manufacturing enterprises is positively correlated with enterprise performance. Han Pengcheng et al. (2020) ^[8] used linear regression to analyze the relationship between enterprise innovation and enterprise value, and found that enterprise innovation ability can effectively improve enterprise value. This research is helpful for us to better study the relationship between R&D investment and firm performance. Therefore, this paper believes that there is a significant positive correlation between the two. In summary, the following hypothesis is proposed:

H3: R&D investment has a significant role in promoting enterprise performance.

2.5 The mediating effect of R&D investment

R&D investment and firm performance. With R&D investment as the intermediary variable, few studies have explored the relationship between financial subsidies, R&D investment and firm performance. Therefore, it is necessary to study the role of R&D investment in financial subsidies and firm performance. The impact of financial subsidies on enterprise performance is mainly to directly affect the amount of financial statements. Ren Zengrui (2011) ^[9] believes that enterprises' investment in innovation and R&D can not only improve their core competitiveness and market share, but also obtain expected profits. He Yun and Li Bihan (2020) ^[10] found empirically that R&D investment has a mediating effect in the process of government subsidies affecting innovation performance. Financial subsidy is a common policy means of the state, and the main purpose of this means is to promote enterprise research and development. In summary, the following hypothesis is proposed:

H4: R&D investment has a partial mediating effect between financial subsidies and firm performance.

3 Data and methods

3.1 Data source

This paper will reveal the impact of financial subsidies and R&D investment on firm performance through empirical analysis, and select the panel data of 281 enterprises from 2017 to 2022 as research samples. In this paper, the net interest rate on total assets is taken as the explained variable, financial subsidies as the explanatory variable, R&D investment as the intermediary variable, and asset-liability ratio, enterprise scale and the shareholding ratio of the largest shareholder as the control variable to build the intermediary effect model. The data of each variable are from the National Tai'an database. In this paper, Excel 2010 was used for data statistics and processing, and Stata17.0 was used for sample data analysis.

3.2 Variable selection

1. Explained variables

The sample in this paper is the data of GEM manufacturing enterprises from 2017 to 2022, and the time span is short, so it is not suitable to use long-term financial performance indicators. In this paper, the net interest rate on total assets (ROA) is used as an indicator to measure enterprise performance, which can ensure the stability of data.

2. Explanatory variables

An explanatory variable in this paper is fiscal subsidy (SUB). However, because some enterprises do not disclose the amount of financial subsidies in detail, and the absolute amount of financial subsidies of different types of enterprises has a large gap, this paper chooses the ratio of government subsidies to total assets as the amount of financial subsidies to ensure the reasonable accuracy of the data.

3. Mediating variables

Research and development investment (RD), the investment of R&D funds in the current year is selected as an indicator to measure the intermediary variable of R&D investment. The logarithmic processing of R&D investment is carried out to ensure the stability of data.

4. Control variables

The asset-liability ratio can measure the debt level and risk degree of an enterprise. A high asset-liability ratio indicates that the more assets are borrowed and the greater the risk is, which will affect the cash flow of the enterprise and then affect the performance of the enterprise. The larger the enterprise scale, the stronger the capital strength and research and development level of the enterprise. The shareholding ratio of the largest shareholder will affect the R&D investment activities of the enterprise and also have a significant impact on the performance of the enterprise. Therefore, this paper selects asset-liability ratio, enterprise scale and shareholding ratio of the largest shareholder as control variables, and the definition of variables is shown in Table 1.

Table 1. Variable definition

Variable	Variable name	Variable code	Variable definition
Explained variable	Net interest rate on total assets	ROA	Net profit/average total assets
Explanatory variable	Financial subsidy	SUB	Government grants/total assets
Mediating variable	R&d investment	RD	LN (R&D Investment)
Control variables	asset-liability ratio	LEV	Total liabilities/total assets
	Enterprise size	SIZE	LN (Total assets)
	equity concentration	TOP1	The proportion of the largest shareholder

3.3 Model design

To test the hypothesis, this paper designs the following model:

$$ROA_{it} = a_0 + a_1SUB_{it} + a_iX_{it} + \epsilon_{it} \quad \text{Model (1)}$$

$$RD_{it} = b_0 + b_1SUB_{it} + b_iX_{it} + \epsilon_{it} \quad \text{Model (2)}$$

$$ROA_{it} = c_0 + c_1RD_{it} + c_iX_{it} + \epsilon_{it} \quad \text{Model (3)}$$

$$ROA_{it} = d_0 + d_1SUB_{it} + d_2RD_{it} + d_iX_{it} + \varepsilon_{it} \quad \text{Model (4)}$$

Model (1) takes financial subsidies as independent variable and net interest rate on total assets as dependent variable to test hypothesis H1; Model (2) takes financial subsidies as independent variable and R&D input as dependent variable to test hypothesis H2; Model (3) takes R&D input as independent variable and firm performance as dependent variable to test hypothesis H3; Model (4) takes financial subsidies as the dependent variable, R&D input as the mediating variable, and firm performance as the dependent variable. It tests the effect of R&D input on firm performance through d_2 , and then tests the mediating effect through a_1 , b_1 , and d_1 to determine whether R&D input has a full or partial mediating effect between financial subsidies and firm performance. In the above model, i represents the enterprise ($i \in [1,686]$), t represents the year ($t \in [2017,2022]$). As shown in Figure 1.

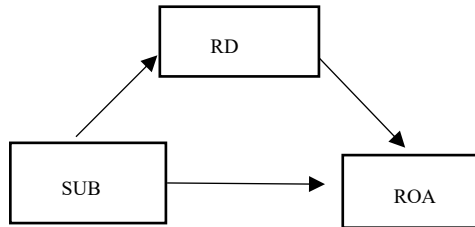


Fig. 1. Schematic diagram of the model

4 Empirical research

4.1 Descriptive statistics

As shown in Table 2, it can be seen from the table that the standard deviation is less than or not much different from the mean, so the extreme value does not exist. The standard deviation of the net interest rate on total assets is 0.085, and the mean is 0.031. It can be seen that the overall level of the net interest rate on total assets is low and the difference is not big. There is little difference between the financial subsidies received by enterprises and the relative amount of R&D investment. The difference between the mean value, the maximum value and the minimum value of the enterprise size is not large, indicating that the development of each enterprise is more balanced. The average asset-liability ratio is 0.38, and the appropriate level of asset-liability ratio is 0.4-0.6, which indicates that enterprises can raise R&D funds through debt. The shareholding ratio of the largest shareholder is quite different, which means that the internal management of GEM manufacturing enterprises is quite different.

Table 2. Descriptive statistical analysis table

Variable	N	Mean	SD	Min	Max
ROA	1686	0.031	0.085	-0.355	0.219
SUB	1686	0.008	0.008	0.001	0.036
RD	1686	18.20	0.944	15.38	20.57
SIZE	1686	21.77	0.867	20.00	24.03
TOP1	1686	28.05	12.07	8.090	71.10
DA	1686	0.380	0.173	0.0580	0.829

4.2 Correlation and multicollinearity analysis

As can be seen from Table 3, financial subsidies, R&D investment and the net interest rate of total assets of the dependent variable are significantly and positively correlated at the level of 1%, indicating that financial subsidies have a positive impact on enterprise performance and R&D investment contributes to enterprise performance. In addition, The correlation coefficient of each variable is less than 0.8, the coefficient between the independent variable and the three control variables is small, indicating that there is no serious multicollinearity problem.

Table 3. Correlation analysis result

Variables	ROA	SUB	RD	SIZE	TOP1	DA
ROA	1					
SUB	0.097***	1				
RD	0.067***	0.165***	1			
SIZE	-0.027	-0.121***	0.812***	1		
TOP1	0.179***	-0.040*	-0.106***	-0.087***	1	
DA	-0.406***	-0.055**	0.280***	0.401***	-0.086***	1

4.3 Analysis of regression results

As can be seen from Table 4, the regression results of Model (1) show that financial subsidies and enterprise performance are significantly and positively correlated at the 1% level. It shows that financial subsidies have a positive incentive effect on enterprise performance, and hypothesis H1 is valid. The regression results of Model (2) show that financial subsidies and R&D investment are significantly and positively correlated at the level of 1%, indicating that financial subsidies promote enterprises' R&D investment. H2 is assumed to be true. The regression results of Model (3) show that R&D investment and firm performance are significantly and positively correlated at the level of 5%, indicating that R&D investment can not only promote product innovation but also improve production efficiency, thus improving firm profitability. Based on the verification of model 1. The regression results of Model (4) show that financial subsidies and firm performance are significantly and positively correlated at the level of 5%. There is a significant and positive correlation between R&D investment and firm performance at the level of 1%. In the third step of the intermediary effect test, both financial subsidies and R&D investment are significantly and positively correlated with firm performance. It shows that R&D investment plays a partial mediating role on firm performance, and the effect of financial subsidies on firm performance is partly indirectly brought about by promoting firm R&D. Therefore, hypothesis H4 is verified. In the control variable part, the size of the enterprise can reflect whether the capital of the enterprise is thick. The larger the scale of the enterprise, the stronger the financial resources of the enterprise, the greater the R&D investment, and the innovation income brought by it is also considerable. The shareholders hope to get more returns, and the shareholders have a positive attitude towards R&D investment. Due to the large risks

and uncertainties of enterprise R&D and innovation, it will have a certain impact on the solvency of enterprises, so creditors will correspondingly reduce investment, so the asset-liability ratio is negatively correlated.

Table 4. Regression analysis of financial subsidy, R&D investment and firm performance

	Model (1)	Model (2)	Model (3)	Model (4)
	ROA	RD	ROA	ROA
SUB	1.158***	10.701***		1.049**
RD			0.017**	0.048***
SIZE	0.035***	0.826***	0.045***	0.081***
TOP1	0.001**	0.003**	0.001**	0.001**
DA	-0.251***	0.265***	-0.244***	-0.268***
cons	-0.680***	-0.0700	-0.591***	-0.874***
N	1686	1686	1686	1686
r2	0.518	0.950	0.517	0.554

4.4 Robustness test

In order to make the conclusion more reliable, this paper uses Sobel and Bootstrap method to further test the research conclusion, and concludes that the P-value of financial subsidy in Sobel test is less than the critical value of 0.05, rejecting the null hypothesis, and part of the intermediary effect is established. The confidence interval of financial subsidy in Bootstrap test did not contain 0, indicating the existence of intermediary effect. Sobel and Bootstrap methods support the conclusions of this study.

5 Conclusion and prospect

The government should increase the intensity of financial subsidies, so that the inducement effect of financial subsidies on enterprise performance will continue to expand, so as to encourage enterprises to continue to innovate and produce, and thus improve enterprise performance. At the same time, enterprises should make good use of the financial subsidies provided by the government, increase research and development investment, in order to achieve better innovation benefits, and constantly improve corporate performance. There is a mediating effect between financial subsidies and firm performance, which reflects the mechanism of financial subsidies on firm performance. This paper provides a new perspective for the study of the relationship between financial subsidies, R&D investment and firm performance.

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