

Research on the Impact of R&D Expenditure Capitalization on Enterprise Performance

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Abstract This paper selects 361 enterprises in China's non-financial listed companies for 2013-2015 years as research samples, establishes a regression model of R&D expenditure capitalization and enterprise performance, and carries out multiple linear regression analysis and robustness test. Meanwhile, the continuity of the impact of R&D expenditure capitalization on enterprise performance is taken into account and validated. The conclusion is that the capitalization of R&D expenditure is positively related to the enterprise performance with continuity.

Keywords: R&D expenditure capitalization, enterprise performance, continuity

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1. Introduction

After the international financial crisis, under the background of great changes in science and technology industry, countries all over the world have begun to attach importance to new things of science and technology, and increase the intensity of R&D input, so as to take the lead in the field of intelligent technology industry in the future. As can be seen from Table 1, the total R&D expenditure in China increased from 868.7 billion yuan in 2011 to 1 trillion and 416.988 billion yuan in 2015 with increase rate of 63.12%. In addition, the funds invested by enterprises in R&D funds are significantly more than those invested by the government, and the proportion of investment from enterprises has increased from 73.91% in 2011 to 74.73% in 2015, which shows that more and more enterprises have realized the important role of R&D for technological innovation and the benefit of enterprises, and the status of enterprises as the main body of technological innovation is constantly strengthening.

Table 1. Research and development expenditure of our country in each year (Unit: billion yuan)

	2011	2012	2013	2014	2015
From government	1882	2221	2500	2636	3013
From enterprises	6420	7625	8837	9816	10588
Others	383	452	508	563	568
Total expenditure	8687	10298	11846	13015	14169
Proportion of enterprise funds (%)	73	74	74	75	74

With the growth of R&D investment, R&D projects have more and more influence on company operation, and their corresponding accounting information has gradually

be focused by stakeholders. The thirty-eighth of International Accounting Standards stipulates that the research expenditure is regarded as the expense, and the development expenditure of the assets will be capitalized. In line with international accounting standards, listed companies in Shanghai and Shenzhen have implemented new accounting standards since January 2007. The regulations on investment in scientific research activities have been changed from total expensing to conditional partial capitalization. Domestic scholars focus more on the relationship between R&D investment and company performance and value, and less targeted research on R&D capitalization. Whether the change of accounting treatment of R&D expenditure is reasonable or is also worth discussing that is the purpose of this study.

2. Theoretical Basis

2.1. Theoretical Basis

At present, the accounting treatment of R&D investment in the world is that expensing tends to the principle of objective, reflecting the status of the company based on the actual situation; capitalization is more focused on the related principle, which is useful for information users. Therefore, the choice of accounting treatment should consider whether the enterprise needs objectivity or bias to relevance. On the one hand, capitalization may be related to value, which can deliver more useful information to market participants to avoid information asymmetry. But the capitalization of R&D expenditure also creates opportunities for managers to engage in earnings management, which may damage the reliability of financial reports. On the other hand, expensing is relatively reliable, but lack of relevance which may damage the enthusiasm of the company in R&D investment, because it reduces the profit

of that year. According to our new guidelines, research expenditure and R&D expenditure of failure projects should be expensed at the time of occurrence. If a scientific research project achieves technical and commercial feasibility and the company can prove that the asset can generate economic benefits in the future, R&D expenditure should be capitalized as assets.

2.2. Hypothesis

Sougiannis and Lev [1] chose listed companies as the research object, examined the relationship between R&D expenditure and business performance, and applied a specific number of methods to simulate the capitalization of R&D expenditure, which was the first case of empirical research. The research shows that the partial capitalization of R&D expenditure plays a positive role in the enterprise performance. In addition, the capitalization of R&D expenditure is also positively related to the performance of the lagged accounting period. Suzanne Landry [2] from 1983 to 2000, chose seven industries as the research sample with more rapid innovation for empirical research based on the enterprise performance optimization generated by R&D capitalization. The results show that partially capitalization treatment of R&D expenditure leads to the degree of association between the value of the enterprise and the expected reward which will be promoted in a certain range. Xu Fang [3] chose A shares of listed companies in Shanghai and Shenzhen as the research sample, evaluated enterprise value by Tobin Q, described enterprise value fluctuations by earnings per share volatility, established regression model to empirically analyze of effect of R&D capitalization strength on enterprise value and value fluctuation, and concluded that there was a significant positive correlation between the intensity of capitalization and the value and volatility of the enterprise.

In reality, if an enterprise has expected economic benefits due to the success of R&D projects, rational investors will find information in financial statements and trust the enterprises, which is reflected in the continuous rise of the company's future profitability, share price and market value. R&D capitalization indicates that development enhances the innovation level of enterprises in a certain extent, creates economic benefits for the enterprise, and ensures that enterprises have their own a space in the competition. Based on this, the hypothesis 1 is proposed.

H1: the capitalization of R&D expenditure is relevant and positively related to the performance of the enterprise.

It is a long process for any intangible asset to be produced and commercialized from generating ideas, deliberation, decision making, planning and exploring new knowledge of science and technology and applying it to actual development, and finally getting profits and improving performance. Many R&D activities of enterprises are a long-term investment which can't succeed at one stroke. Its duration will involve many accounting periods, not just an accounting period. The study of Cheng Hongwei and Sun Yujun [4] and Sun Yujun [5] also show that R&D expenditure is lagging behind in enterprise performance. Then put forward the hypothesis 2:

H2: the capitalization of R&D expenditure has a continued impact of enterprise performance.

3. Research Design

3.1. Sample Data

We choose Chinese listed non-financial companies as the research samples, excluding companies with ST, 0 development expenditures of 1 year or three consecutive years, extremely small relative strength and some abnormal data. 361 companies are chosen; and three years annual financial data from 2013 to 2015 are selected from the CSMAR database, then we process and analyze them with EXCEL and SPSS.17.0 statistical analysis software.

3.2. Variables Selection

(1) Independent variable

We discuss the impact of R&D expenditure capitalization on enterprise performance, and the samples are multi industry and multi scale firms with multiple research inputs. Relative index of R&D expenditure capitalization intensity is independent variable, which makes the empirical results more representative and effective. After the new version of the guidelines put into practice, the enterprise's balance sheet increases the "development expenditure" column to indicate the amount of R&D capitalization expenditure which doesn't form intangible assets.

(2) Dependent variable

Referring to other documents, the net profit rate of business income is used to measure the performance of the enterprise. The index reflects the ability of the company's operating income to gain net profit, the higher the ratio, the stronger the profitability and the better the performance.

(3) Control variable

Enterprise performance is not only influenced by R&D expenditure, but also influenced by other factors. Considering the importance of elements and the availability of data, we take enterprise scale, capital structure, growth ability and income tax level as control variables, and study the relationship between R&D expenditure capitalization and enterprise performance more accurately. Referring to the existing literature research, the above four variables are expressed in terms of assets logarithm, asset liability ratio, operating income growth rate and income tax rate respectively.

3.3 Model Establishment

Considering the hypothesis and the selection of control variables, in order to analyze the impact of R&D expenditure capitalization on enterprise performance, the following multiple linear regression model is established.

Model 1:

$$NOI = \beta_0 + \beta_1 CAP_R + \beta_2 SIZE + \beta_3 LEV + \beta_4 GROWTH + \beta_5 TAX + \varepsilon$$

Model 2

$$NOI_{t+1} = \beta_0 + \beta_1 CAP_R_t + \beta_2 SIZE_{t+1} + \beta_3 LEV_{t+1} + \beta_4 GROWTH_{t+1} + \beta_5 TAX_{t+1} + \varepsilon$$

Model 1 is used to study the correlation between the capitalization of R&D expenditure and enterprise performance. Model 2 mainly discusses the continuation of the relationship, and T represents the time period.

Table 2. Definition of model variables

Symbol	Definition of variables
CAP_R	capitalization of R&D expenditure / business income
NOI	Net profit/business income
SIZE	Logarithm of assets
LEV	Asset liability ratio
GROWTH	Growth rate of operating income
TAX	Income tax expenses / business income

4. Empirical Analysis

4.1. Descriptive Analysis

From Table 3, we can see that the average capitalization intensity of R&D expenditure is about 2.73%, 2.97% and 3.25% over the past three years, showing an increasing trend year by year, which indicates that enterprises are paying more and more attention to R&D activities, and gradually understand and accept the capitalization of R&D expenditure. In the three year comprehensive data, the biggest difference between maximum and minimum values is the growth rate of business income, and the standard deviation of operating income growth rate is relatively large, which indicates that there is a big gap between the growth ability of enterprises. The small

standard deviation of the capitalization intensity of the independent variable R&D expenditure and the low dispersion degree of the sample data also show that the disparity between the capitalization intensity of R&D expenditure of different sample enterprises is not very large.

4.2. Correlation Analysis

In order to understand the relationship between R&D expenditures and enterprise performance, we conduct correlation test for all the variables based on date of three years. Listed in Table 4, correlation coefficient of CAP_R and NOI is 0.148, and passes the 1% confidence level test. The NOI has a negative correlation with company size at 5% significant level, and at 1% with significant level of the asset liability ratio LEV, and has a significant positive correlation with the income tax rate at 1% level. In addition to the growth rate of business income, other variables are significantly related to NOI. There is no correlation between the growth rate of business income and other variables, which is influenced by its high degree of discreteness.

In order to test hypothesis 2, we conducts Pearson correlation double test on R&D expenditure capitalization intensity in 2013, with NOI and control variables of 2014, that is, t values 2013 in model 2. The results are shown in Table 5 below. Analysis shows: Pearson correlation coefficient in 2013 of R&D capitalization strength and 2014 NOI was 0.152 at 1% significance test level, indicating that a distinct positive impact of capitalization intensity on NOI of later years, namely the capitalization and enterprise performance of next year is significantly related.

Table 3. Descriptive statistics of variables

Year	variables	Maximum values	Minimum values	Mean values	Standard deviation
2013	NOI	0.96	-0.94	0.09	0.14
	CAP_R	0.35	0.00	0.02	0.04
	SIZE	26.16	19.32	21.94	1.23
	LEV	0.93	0.02	0.39	0.21
	GROWTH	104.53	-0.40	0.51	5.51
	TAX	0.28	-0.01	0.01	0.02
2014	NOI	1.32	-0.63	0.09	0.13
	CAP_R	0.60	6.92	0.02	0.04
	SIZE	26.38	19.28	22.12	1.22
	LEV	0.96	0.02	0.40	0.20
	GROWTH	12.55	-0.53	0.20	0.78
	TAX	0.33	-0.02	0.01	0.02
2015	NOI	1.18	-3.19	0.06	0.23
	CAP_R	0.81	3.24	0.03	0.06
	SIZE	26.72	19.23	22.30	1.21
	LEV	1.00	0.03	0.41	0.19
	GROWTH	6.78	-0.64	0.16	0.50
	TAX	0.58	-0.04	0.01	0.03
synthesis Of 3 years	NOI	1.32	-3.19	0.08	0.17
	CAP_R	0.81	6.92	0.02	0.05
	SIZE	26.72	19.23	22.12	1.23
	LEV	1.00	0.02	0.40	0.20
	GROWTH	104.53	-0.64	0.29	3.23
	TAX	0.58	-0.04	0.01	0.02

Table 4. Pearson correlation test of Three-year comprehensive variables

		NOI	CAP_R	SIZE	LEV	GROWTH	TAX
NOI	r	1	0.148**	-0.117*	-0.417**	-0.014	0.677**
			0.005	0.026	0.000	0.795	0.000
CAP_R	r	0.148**	1	-0.214**	-0.269**	-0.020	0.025
		0.005		0.000	0.000	0.700	0.636
SIZE	r	-0.117*	-0.214**	1	0.630**	0.037	-0.069
		0.026	0.000		0.000	0.479	0.191
LEV	r	-0.417**	-0.269**	0.630**	1	0.067	-0.314**
		0.000	0.000	0.000		0.206	0.000
GROWTH	r	-0.014	-0.020	0.037	0.067	1	-0.020
		0.795	0.700	0.479	0.206		0.707
TAX	r	0.677**	0.025	-0.069	-0.314**	-0.020	1
		0.000	0.636	0.191	0.000	0.707	

a:**. 1% significant level, *. 5% significant level

Table 5. Pearson correlation test of variables last 1 year

		NOI	CAP_R	SIZE	LEV	GROWTH	TAX
NOI	r	1	.152**	-.071	-.435**	.215**	.765**
			.004	.178	.000	.000	.000
CAP_R	r	.152**	1	-.213**	-.253**	.056	.055
		.004		.000	.000	.288	.294
SIZE	r	-.071	-.213**	1	.602**	.035	-.062
		.178	.000		.000	.508	.239
LEV	r	-.435**	-.253**	.602**	1	-.045	-.309**
		.000	.000	.000		.390	.000
GROWTH	r	.215**	.056	.035	-.045	1	.123*
		.000	.288	.508	.390		.019
TAX	r	.765**	.055	-.062	-.309**	.123*	1
		.000	.294	.239	.000	.019	

a:**. 1% significant level, *. 5% significant level.

4.3. Regression Analysis

Pearson correlation analysis shows that capitalization strength and NOI, capitalization strength of 2013 and NOI of 2014 are positive correlated based on three-year data at 1% significant test level, but the conclusion is not considering four control variables. In order to make the comprehensive index accurate, the multiple regression analysis is carried out on the basis of model 1 and 2. The regression results are shown in Table 6, Table 7, and Table 8.

From Table 6, we can see that the R² calculated by model 1 after adjustment is 0.512, the standard estimation error is 0.099, the adjusted R² of model 2 is 0.658, and the standard estimation error is 0.079. The results show that

the fitting degree of the two models is higher, the equation is significant and the sample statistics are more representative. In Table 7, the significance of the two equations is less than 0.05, indicating that the model can establish a regression equation for subsequent studies through a significant test.

Table 6. Model Summary

model	R	R ²	Revised R ²	Standard estimation error
1	.720 ^a	.519	.512	.099
2	.814 ^a	.663	.658	.079

a. Predictive variable: (constant), TAX, GROWTH, CAP_R, SIZE, LEV.
b. dependent variable: NOI.

Table 7. Anova^b

	model	Sum of squares	df	Mean square	F	Sig.
1	regression	13.730	5	1.746	76.581	.000 ^a
	residual	3.458	1077	.010		
	Total	17.187	1082			
2	regression	4.374	5	.875	139.805	.000 ^a
	Residual	2.221	355	.006		
	total	6.595	360			

a. Predictive variable: (constant), TAX, GROWTH, CAP_R, SIZE, LEV. b. dependent variable: NOI.

Table 8. variable ^a

model		Non standardized coefficient		Standard coefficient		
		B	Standard error	Trial Edition	t	Sig.
1	(constant)	-.210	.113		-1.866	.063
	CAP_R	.270	.126	.082	2.145	.033
	SIZE	.014	.005	.121	2.516	.012
	LEV	-.188	.034	-.286	-5.547	.000
	GROWTH	.000	.001	.014	.387	.699
	TAX	3.594	.239	.593	15.044	.000
2	(constant)	-.304	.090		-3.387	.001
	CAP_R	.208	.100	.066	2.076	.039
	SIZE	.018	.004	.166	4.235	.000
	LEV	-.199	.027	-.309	-7.430	.000
	GROWTH	.019	.005	.110	3.519	.000
	TAX	3.720	.185	.663	20.073	.000

a. dependent variable: NOI.

From Table 8, it can be concluded that the sig. of capitalization intensity of R&D expenditure and NOI of model 1 are 0.033, less than 0.05, and the standard correlation coefficient is 0.082, indicating a significant positive correlation between them. This proves that hypothesis 1 is established. Among the control variables, firm size and income tax rate is positively related to NOI, and asset liability ratio is negative related to NOI with the standard coefficient of 0.286.

The Sig. of independent variable and dependent variable of model 2 is 0.039, less than 0.05, and the standard correlation coefficient is 0.066, both of them are significantly correlated, indicating R&D capitalization intensity of 2013 have significant positive effects on NOI of 2014, which indicates significant positive correlation of capitalization and late enterprise performance, that is to say hypothesis 2 is established.

4.4. Robustness Test

There are many indicators to express enterprise performance. The above results have been demonstrated by NOI. In order to improve our study, the robustness test is carried out here. We change NOI of the dependent variable to ROA (net profit/total assets) to describe enterprise performance. The variable of company size is replaced by natural logarithms of assets.

5. Conclusions and Suggestions

A series of analyses conclude that R&D expenditure capitalization is positively correlated with enterprise performance. When companies are biased towards R&D expenditure capitalization, the higher the capitalization level is, the better the performance will be. In addition, the relationship between R&D capitalization and performance has continuity that the relationship between the current capitalization and the performance of next period is related. The correlation between asset liability ratio and performance is negative which shows that when other conditions are fixed, the greater the asset liability ratio is, the worse the performance will be. The following suggestions are put forward.

Distinction standard of specific research and development is concentered. R&D activities are divided into different periods of research and development. Standards provide that the related inputs should be regarded as management expense during the research period, and inputs in the development period should be capitalized. Therefore, how to distinguish the research and development stage is very important. The distinction standards should be specific.

Complete disclosure of relevant information on R&D input is strictly required. In the process of sample data collection, many enterprises' R&D investment information disclosure is incomplete or not disclosed, so it is difficult to evaluate their R&D activities. Not perfect information disclosure will cause the information users not accurately understand the financial situation of the enterprise, and have an impact on the decision. However, mandatory disclosure of complete information is appropriate and not strictly mandatory. For enterprises that R&D expenditure is less, R&D activities can be properly disclosed that have no significant impact on overall economic activities and user interests.

Increase R&D expenditure and expedite the research stage into the development stage. We draw a conclusion that the capitalization of R&D expenditure is positively related to the enterprise performance and has continuity. Therefore, enterprises should put their eyes on the long-term, not only focus on short-term interests, actively carry out scientific research and innovation, and respond to the national scientific research call. Enterprises should also promote the process of research into development, and maximize the commercialization of scientific research and technology. If R&D stays in the research period for a long time, a large amount of expensing expenditure will be generated to reduce the performance of the enterprise.

Strengthen internal control and improve supervision. R&D activities are a long duration process. Enterprises need to strictly supervise and manage in every link and process, so as to minimize the losses caused by errors. Due to separation of ownership and management, managers improve their salaries by using expensing process to regulate profits for smoothing earnings. Then companies will need to strengthen supervision, and particularly record the expensing and capitalization of

R&D expenditures. If the company sets up a strict system of supervision and internal control, implements the specific responsibilities of various staff, then a good internal environment will boost the company's growth and development.

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