

# A STUDY ON R&D EXPENDITURE AND CORPORATE VALUE OF CHINESE HIGH-TECH INDUSTRY

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## Abstract

This paper examines the impact of research and development (R&D) expenditure, R&D capitalized expenditure and expensed expenditure on the corporate value. Through the exposition of R&D expenditure affect relevance of corporate value after the Chinese New Accounting Standards, it can be found that R&D expenditure information has a positive effect on share price. The disclosure of information on R&D expenditure has a positive relevance to corporate value means that the disclosure of R&D expenditure information can improve the value relevance of accounting information. Investors give positive value to the R&D capitalized and expensed expenditure, but R&D capitalized expenditure has a greater effect on investors than R&D expensed expenditure. At the same time, the normative degree of R&D expenditure disclosure has a significant positive effect on the stock price, which shows that the disclosure of R&D expenditure information can improve the value relevance of accounting information.

**Keywords:** Chinese High-tech industry, R&D capitalized expenditure, corporate value

**JEL Classification:** C33, G30, M41, O14

## 1. Introduction

In the era of knowledge economy and a highly competitive market environment, the importance of knowledge and technology in

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the enterprise is more and more significant. R&D expenditure is the source of technological innovation and the core competitiveness for enterprises. It is generally believed that R&D activities can improve the corporate value and the ability of enterprises to utilize existing knowledge and technology. Therefore, R&D expenditure can promote the innovation ability and absorption capacity of enterprises.

High-tech enterprises refer to the development of science and technology or scientific inventions in new areas or to innovation in the original area. On the basis of defining the scope of Chinese high-tech industry, the concept of high-tech enterprises in China can be defined from the "Measures for the Administration of High-tech Enterprises" promulgated by China in 2008. Therefore, high-tech enterprise generally refers to the state promulgated of "The fields of high-tech supported by the state," within the scope of continuous R&D and technological achievements into the core of independent intellectual property rights. As this basis to carry out the business activities are the economic entities of knowledge-intensive and technology-intensive.

Independent innovation of enterprises allows enterprises to provide better products and get a good space for development in the market. The key factor in the future prospects of high-tech enterprises is the level of scientific research and technology, and the financial condition and operating results only reflect the existing development capacity of enterprises. The R&D investment of the enterprise can reflect the importance and determination of the enterprises to improve the core competitiveness and strengthen the independent innovation. R&D activities play a pivotal position in the process of improving the level of technological innovation in high-tech enterprises. Therefore, R&D has a very important utility in corporate activities. R&D expenditure has also become one of the important criteria for evaluating and measuring the value of high-tech companies. Investors and stakeholders are more pressing to understand the details of R&D information and R&D expenditure, so as to better assess whether a company has a strong competitive edge, as well as good growth and high value.

"New Accounting Standards" were announced on February 15, 2006, and the "New Accounting Standards" began to be implemented in more than 1,400 listed companies in China on January 1, 2007. With regard to intangible assets, the New Accounting Standard and the International Financial Reporting Standards (IFRS) converge, the first one is that the intangible assets are not included in goodwill. The

second, the R&D expenditures of the intangible assets are included in the management costs, however, the R&D is divided into R&D capitalized expenditure and R&D expensed expenditure. The expenditure shall be capitalized and recognized as intangible assets when it is proved that the given five conditions exist, which are:

1. It is possible to complete the intangible asset so that it can be used or sold.

2. Have the intention to complete and use or sell the intangible asset.

3. The way in which intangible assets generate future economic benefits, includes the product which uses the intangible assets has the markets, or the intangible assets has its own market, and intangible assets will be used internally, should prove its usefulness.

4. Have sufficient technical, financial and other resources to support the completion of the development of the intangible assets and the ability to use or sell the intangible assets.

5. Expenditure which is attributable to the stage of intangible assets can be quickly measured, however, for the R&D expenditures that cannot be distinguished from the research and the development phase, they are fully expensed and included in the current profit and loss.

This paper attempts to explore the relationship between R&D expenditure and corporate value through empirical research, to assess the corporate value for investors and stakeholders.

## **2. Literature review**

With the constantly accelerating economic globalization and the rapid development of high technology, to maintain their core competitiveness, they must improve their technological innovation capability. Technological innovation can be successfully achieved largely dependent on the progress of enterprise R&D activities. The impact of R&D activities expenditure on corporate value also attracts the interest of many scholars (Toivanen et al., 2002; Eberhart et al, 2004; Anagnostopoulou, 2008). This paper describes the impact of R&D expenditure, capital expenditure, expense expenditure on corporate value to conduct a review and summarize a conclusion and suggestion.

With the increasing amount and proportion of R&D expenditures, researches on the relationship of R&D expenditure and

corporate value are more abundant and comprehensive, scholars had carried out systematic and in-depth studies (Aboody and Lev, 1998; Hu and Jefferson, 2004; Lee and Kim, 2013). These findings provided empirical evidence and valuable advice to the management and investors of the enterprise. Works of literature confirmed the positive effect of R&D expenditure on corporate value (Duqi and Torluccio, 2010; Dave et al., 2013; Yang, 2013; Ju et al., 2013). Researchers are absolutely endless after the implementation of the new guidelines, but few scholars specifically carry out the research for R&D activities and corporate value of high-tech enterprises (Tang et al., 2013; Huang and Wu, 2014; Guo and Wang, 2014).

The impact of R&D capitalized and expensed expenditure on corporate value has been controversial. Callimaci and Landry (2004) found that R&D expensed expenditure would affect investors' assessment of corporate profitability and value judgments, leading to erroneous expectations of share and net asset returns. Researches proposed that the R&D capitalized expenditure has stronger positive correlation with corporate value than R&D expensed expenditure (Lev et al., 2005; Ahmed and Falk, 2006; Zhao and Liang, 2009), but some researches pointed out that the R&D capitalized expenditure is negatively correlated with the corporate value (Cazavan-Jeny and Jeanjean, 2006; Oswahi, 2008).

Based on the above literature, this paper attempts to discuss the impact of R&D expenditure, capitalized expenditure and expense expenditure on the corporate value through the collection, collation and statistical analysis of the relevant data of high-tech enterprises in 2014-2016 for China.

### **3. Methodology**

The data in this paper is from the financial statements and notes of the enterprises of Torch High Technology Industry Development Center and Ministry of Science and Technology of China. The samples are selected on the basis of the state-approved high-tech enterprise evaluation standards, excluding the financial class and ST listed companies (Tang et al., 2013), and in accordance with the "the Guidelines for the Administration of the Recognition of Hi-tech Enterprises", select A-share listed companies of important high-tech enterprises which had been identified as Torch High Technology Industry Development Center from 2014 to 2016 as the sample. In

order to ensure the validity of the data, the selected samples are all listed A-share high-tech enterprises in 2014, and the financial information must be complete for 2014 to 2016 for three consecutive years, any missing samples are removed, a total collection of 600 companies and 1800 observations. This paper constructs the basic model of multiple linear regression analysis to test and analyze the relationship between R&D expenditure and corporate value. The definition of variables is shown in Table 1.

**Table 1**

**Definition of Variables**

Variable Type	Description
Dependent Variable	<p>Tobin's Q ratio is a ratio devised by Tobin(1969), hypothesized that the combined <u>market value</u> of all the companies on the <u>stock market</u> should be about equal to their replacement costs. A low Q (between 0 and 1) implies that the stock is <u>undervalued</u>. Conversely, a high Q (greater than 1) implies that the stock is <u>overvalued</u>.</p> <p><math>TQ = \text{total market value of firm} / \text{total asset value of firm} = (\text{equity market value} + \text{liabilities market value}) / (\text{equity book value} + \text{liabilities book value})</math></p>
Independent Variables	<p>Expenditure on research and development (R&amp;D) is one of the most widely used measures of innovation inputs.  <math>RD = \text{total R\&amp;D expenditure} / \text{total assets}</math></p> <hr/> <p>R&amp;D capitalized expenditure, are funds used by a company to acquire or upgrade <u>physical assets</u> such as property, industrial buildings or equipment. It is often used to undertake new projects or investments by the firm.  <math>CAPRD = \text{R\&amp;D capitalized expenditures} / \text{total assets}</math></p> <hr/> <p>R&amp;D expensed expenditure is a type of <u>operating expense</u> and can be deducted as such on a business <u>tax return</u>. This type of expense is incurred in the process of finding and creating new products or services.  <math>EXPRD = \text{R\&amp;D expensed expenditures} / \text{total assets}</math></p>

	<p>Total <u>debt</u> to total <u>assets</u> is a <u>leverage ratio</u> that defines the total amount of debt relative to assets. The higher the ratio, the higher the degree of leverage, and consequently, financial risk.</p> <p><math>ALR = (\text{short term debt} + \text{long term debt}) / \text{total assets}</math></p>
Controlled variables	<p>Enterprise size refers to the workers, labor, labor and other factors of production and products in the concentration of enterprise.</p> <p><math>SIZE = \text{LN}(\text{total assets})</math></p>
	<p>Growth refers to a positive change in size, and/or <u>maturation</u>, often over a period of time. For investors, growth rates typically represent the compounded <u>annualized rate</u> of growth of a company's revenues.</p> <p><math>OIGR = \text{Increase of business revenue} / \text{business revenue for the previous year}</math></p>

*Note: Calculations are based on data from The Ministry of science and technology the torch high technology industry development center*

Enterprises have various expenses in order to carry out R&D activities, including human resources costs and the purchase of machinery and equipment, these expenses will bring unique experience, technology, and knowledge. According to the theory of accounting information quality, the better quality and qualified accounting information will meet the specific or potential demands of investors. Capitalized the R&D expenditure which meets the criteria will improve the accounting information quality of enterprises and be conducive to investors to make the right judgment on corporate value. Lev and Sougiannis (1996) and pointed out that R&D capitalized expenditure is helpful to reduce the information asymmetry between firms and investors. Ahmed and Falk (2006) also demonstrated that R&D capitalized expenditure had an incremental ability to interpret stock prices and also supported the corporate value relevance of R&D capitalized expenditure. In the high-tech enterprises characterized by technology-intensive, high-growth and rapid development, the R&D expensed expenditure is the information that investors pay special attention to R&D activities, thus affecting the corporate value. R&D expenditure plays a role in promoting corporate value. If the R&D activities of the enterprise can be successful and bring future economic benefits to the enterprise, it will surely strengthen the confidence of

investors to the invested enterprise and make the corporate value improved when they obtain the information. In summary, this paper proposes the following research assumptions:

**Hypothesis 1: R&D expenditure has a positive effect on corporate value in Chinese high-tech industry.**

Model 1 is constructed as follows:

$$TQ_{it} = \alpha_0 + \alpha_1 RD_{it} + \alpha_2 LEV_{it} + \alpha_3 SIZE_{it} + \alpha_4 OIGR_{it} + \varepsilon_{it}$$

**Hypothesis 2: R&D capitalized expenditure has a positive effect on corporate value in Chinese high-tech industry.**

Model 2 is constructed as follows:

$$TQ_{it} = \beta_0 + \beta_1 CAPRD_{it} + \beta_2 LEV_{it} + \beta_3 SIZE_{it} + \beta_4 OIGR_{it} + \varepsilon_{it}$$

**Hypothesis 3: R&D expensed expenditure has a positive effect on corporate value in Chinese high-tech industry.**

Model 3 is constructed as follows:

$$TQ_{it} = \gamma_0 + \gamma_1 EXPRD_{it} + \gamma_2 LEV_{it} + \gamma_3 SIZE_{it} + \gamma_4 OIGR_{it} + \varepsilon_{it}$$

#### 4. Empirical results

In this chapter, descriptive statistics is used to understand the characteristics and development trend of all variables during the study period, including the mean, the maximum value, the minimum value and the standard deviation, and panel data regression models are used to explore the impact of R&D expenditure, R&D capitalized expenditure and R&D expensed expenditure on corporate value.

Table 2 shows that the mean of TQ is 1.8399, implies that the value of firm's stock is more expensive than the replacement cost of its assets in most high-tech enterprises, but the stock is undervalued in few enterprises, the cost to replace their assets is greater than the value of the stock. The larger range of RD indicates the larger gap in the scale of capital investment on R&D activities in Chinese high-tech listed companies, reflects the different high-tech enterprises that have different degrees of attention on R&D. The minimum of CAPRD and EXPRD are zero, which means that not every enterprise will be conditional capitalized, Fully R&D capitalized or expensed expenditure is also the situation enterprises often faced. The maximum and mean of the R&D expensed expenditure is greater than the R&D capitalized expenditure, which reflects the proportion of R&D expenditure in the

sample business is much higher than the R&D capitalized expenditure. The most appropriate asset-liability ratio should be less than 0.5 and the mean of ALR is 0.3749, indicating most high-tech enterprises in China keep the solvency up. The range of OIGR shows that the growth ability of each listed high-tech enterprise in China is different.

**Table 2**

**Descriptive Statistics**

Variable	Min	Max	Mean	Std. Dev.
TQ	0.6991	11.4907	1.8399	0.9830
RD	0.0000	0.4296	0.2903	0.1094
CAPRD	0.0000	0.0718	0.0007	0.0037
EXPRD	0.0000	0.3574	0.2894	0.1793
SIZE	-9.2103	27.1373	21.0403	1.7467
ALR	0.0153	0.9441	0.3749	0.1953
OIGR	-100.0000	2775.551	13.4111	79.0995

*Note: Calculations are based on data from The Ministry of science and technology the torch high technology industry development center. Definitions of variables are provided in Table 1.*

Table 3 shows the results of Hausman test show that the three models are fixed-effect models. Asset-liability ratio and firm size have a negative impact on corporate value, and the growth of enterprises has a positive effect on corporate value, indicates that the growth of enterprises can enhance corporate value, but to expand the scale of enterprises does not necessarily achieve the promotion of corporate value. In the case of scale, asset-liability ratio and growth, the coefficient of R&D expenditure is significantly larger than 0, which proves the first hypothesis.

**Table 3**

**Results of Panel Data Regression**

	Model 1	Model 2	Model 3
	Coefficient (Std. Error)		
Constant	3.076***(0.282)	2.489***(0.143)	3.068***(0.284)
RD	6.597***(0.755)		
CAPRD		30.874***(3.516)	
EXPRD			6.254***(0.763)
SIZE	-0.026***(0.007)	-0.023***(0.007)	-0.087***(0.014)
ALR	-0.356*** (0.094)	-0.849***(0.046)	-0.351*** (0.091)
OIGR	0.010***(0.002)	0.011(0.001)	0.005***(0.002)



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	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
	Coefficient (Std. Error)		
F-statistic	133.883	168.958***	74.914***
R <sup>2</sup>	22.98%	27.35%	18.92%
Adjusted R <sup>2</sup>	22.81%	27.19%	18.68%
Hausman Test	Fixed effect	Fixed effect	Fixed effect

\*\*\*Significant at level 0.01.

*Note: Calculations are based on data from The Ministry of science and technology the torch high technology industry development center. Definitions of variables are provided in Table 1.*

This shows that the R&D expenditure of high-tech enterprises listed in China has delivered reasonable information on R&D activities to the market, which goes to improve the corporate value. R&D capitalized expenditure has a significant positive effect on corporate value, which is consistent with the second hypothesis, indicating that R&D activities can be successful and will bring economic benefits to enterprises in the future. When investors acquire the information about R&D successes, will be fully confident of invested enterprises, increase the initiative of investments to improve the corporate value. The results of model 3 show the R&D expensed expenditure has a significant positive effect on the corporate, which is consistent with the third hypothesis. High-tech enterprises note "management fees" and "other payment of cash related to operating activities" in the report to have a brief exposition of R&D expensed expenditure. Compared with other expenses such as "advertising expenses" and "office expenses", the information of R&D expensed expenditure passes a positive signal to investors. Although R&D expenditure is included in the period, the expenses do not mean the success of the R&D activities and the formation of technological achievements for enterprises, but the R&D expensed expenditure gives intimations to investors that companies are carrying out R&D activities. Although the R&D strategy of the enterprise will affect the profit situation in the short term, the formation and development of the independent innovation technology will enhance the core competitiveness of the enterprises, investors are more confident of the enterprises, so the R&D expensed expenditure will have a positive effect to corporate value.

## **5. Discussion**

R&D activities are the driving force for sustainable development and core competitiveness of enterprises, especially in the high-tech industry which occupies an important position in the economic activities of enterprises. For investors, R&D is very important information to evaluate the corporate value. The empirical result of this paper is more convincing for the research of high-tech enterprises in China specifically. It has a positive effect when investors assess the value of the company knowing the disclosure of the R&D expenditure information of high-tech companies. When the enterprise's emphasized on research and development activities, the greater the intensity of investment in R&D activities and the amount of R&D expenditure become, investors on the level of technological innovation and future development prospects increase in popularity, allowing them to predict higher market value of the enterprise. As a result, the R&D activities of enterprises become able to enhance the value of the company's business activities.

The main contribution of this paper is to find out that most of Chinese listed high-tech companies are developing in the research-based stage through the empirical analysis. The R&D activities in the initial development stage are cleaver, therefore the R&D successful information obtained by investors can satisfy their judgment for the value of the technology companies. The R&D activities can enhance the corporate value, so the enterprises should strengthen the R&D activities and increase the proportion of R&D expenditure. In addition, the enterprises should expose the information of R&D expenditure timely and fully to help investors evaluate the corporate value reasonably.

## **6. Conclusions and suggestions**

From the information collated in this article, 57.343% of the enterprises in the past involved the R&D expenditure as the total cost of the other companies in which are also on the R&D expenditure conditional capitalization. This shows that Chinese listed high-tech enterprises are mostly in the basic stage of research, having just entered the development stage, where R&D activities are clearer, thus enabling investors' access to successful R&D information to make reasonable judgments of the value that would meet their high-tech standards.

The second stage of “Chinese new accounting standards” for the R&D stage had been defined, different environmental and technological activities of industry, made the results of their research not the same. It is easier to distinguish between the effectiveness of corporate financial reporting information, investors on the capitalization of R&D spending become more recognized. Capitalized expenditure on the value of Chinese listed high-tech enterprises still has a strong explanatory power which can truly reflect the value of the enterprise. At present, the successful rate of R&D of high-tech enterprises is high, and the R&D results are clear, which can meet the requirements of investors in judging whether the R&D projects are successful. Therefore, investors have a high degree of concern about capitalization.

In order to improve the probability of successful R&D, enterprises should be fully investigated before the activities of R&D. Extensive information collection, analysis of internal and external environment should be also undertaken as accurate as possible to make market forecasts and understand consumer demand changes. According to their own business to choose the best program, and then follow the R&D projects and process to complete the enterprise's innovative activities, as much as possible to achieve high input and high output. At the same time, they should improve the R&D organizational system, develop appropriate incentive system to absorb the talents to the field of R&D, as well as to take a variety of forms of business and scientific research closely linked to improve the efficiency of scientific and technological achievements into practical productivity.

And the government should give a certain economy compensation and also provide strong backing to support the development to encourage enterprises to develop innovative financial, tax incentives, loans, and other policies. At present, the Chinese tax law provides that in the calculation of corporate income tax, R&D expenses can be deducted. In the future, the government should increase the support of enterprise science and technology R&D from various aspects, to provide high-tech enterprises with self-innovation and scientific and technological progress, so that enterprises can concentrate on R&D activities and improve R&D efficiency.

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