Science and Technology Innovation Board IPO R & D Whitewashing and R & D Investment

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Abstract. Science and Technology Innovation Board registration system brings opportunities for many scientific innovation enterprises which are not profitable at this stage but have good growth. However, in order to achieve the purpose of using policy dividends after listing, some IPO companies have carried out R & D manipulation. Taking all the companies that completed the listing audit from Science and Technology Innovation Board's listing to June 31, 2022 as the initial research samples, this project explores whether Science and Technology Innovation Board listed companies have "R & D whitewashing" behavior before listing, and empirically analyzes the impact of R & D investment intensity on R & D whitewashing. The research shows that a high proportion of the companies listed in the application department do have R & D whitewashing behavior. Therefore, this study hopes to help investors guard against R & D whitewashing behavior and optimize the financial market through the intelligent identification of data.

Keywords: Science and Technology Innovation Board; R & D whitewashing; R & D investment

1 Introduction

In the proposal of the CPC Central Committee on formulating the 14th five-year Plan for National Economic and Social Development and the long-term goal of 2035, it is clearly pointed out that innovation should be placed at the core of the overall situation of development, and high-quality development should be led by the independence of high-level science and technology. In the report of the 20th National Congress of the Communist Party of China (CPC), it is necessary to "perfect the system of scientific and technological innovation" and "speed up the implementation of the strategy of innovation-driven development."

In order to thoroughly implement the major decisions and plans of the CPC Central Committee, and to strengthen policy guidance and accurate support for small and medium-sized scientific and technological enterprises, the Ministry of Science and Technology has formulated "some policies and measures for supporting small and

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medium-sized Scientific and technological Enterprises to accelerate Innovation Development in the New period." Science and Technology Innovation Board mainly serves the scientific and technological innovation enterprises and does not regard the performance of the company as a rigid condition for whether to issue stocks or not. Even if the company is in the R & D stage and has a low operating income, it can go public. We will provide new financing channels and inject new momentum for development to high-end industries. Although Science and Technology Innovation Board provides opportunities for many companies, but also has a certain listing threshold, in view of its scientific and technological innovation orientation attribute, the CSRC has made clear provisions on the amount of R & D investment and its proportion of sales revenue and the proportion of R & D personnel. In July 2022, the Shanghai Stock Exchange issued the guidelines for the Application of Science and Technology Innovation Board listing rules of Shanghai Stock Exchange No. 7-Medical device Enterprises apply the fifth set of listing standards, which further clarified the attributes and requirements of enterprises listed in Science and Technology Innovation Board.

Under the policy dividend, the enthusiasm of scientific innovation enterprises in China is high, in recent years, Science and Technology Innovation Board has become a hot topic. However, Science and Technology Innovation Board has the phenomenon of imperfect and inadequate information disclosure, unclear and irregular boundaries, deterioration of firms' innovation performance and inhibition of high-quality development.[1] Efficient R&D activities are an important foundation for enterprise innovation and economic growth. However, due to the existence of information asymmetry and management self-interest, the high-tech industrial policy has triggered a pandering effect in the implementation process, which promotes rent-seeking behaviors of R&D whitewashing by enterprises, and is not conducive to the enhancement of enterprise R&D performance and sustainable development of innovation.[5] Although the evaluation index system of enterprise science creation attribute is becoming more and more perfect, and the audit requirements of enterprise science creation attribute are becoming more and more strict by the relevant departments, Science and Technology Innovation Board registration system has triggered the adverse selection behavior of enterprises to a certain extent, resulting in R & D manipulation such as manipulation of financial statements and "pooling" R & D investment in order to make use of national preferential policies and meet the requirements of science and innovation attribute audit, in order to defraud the state preferential policies and enjoy policy dividends. Achieve profit goals and gain personal benefits from managers[2]. Between 2018 and 2019, Hanyu Pharmaceutical Industry signed six false medical research and development contracts, taking the operation of "packaging the fees paid to agents into R & D fees", involving a contract value of more than 80 million. At this point, the main research question of this paper is whether there is "R & D whitewashing" behavior before Science and Technology Innovation Board listed companies go public. If there is a "whitewash behavior" how to carry out intelligent recognition of it? What governance mechanisms can inhibit Science and Technology Innovation Board's "R & D whitewashing" behavior?

The main contributions of this paper are as follows: first, combined with the realistic background of science creation board, it enriches the related research of R & D

whitewashing of IPO Company, fills up the blank of R & D whitewashing in the field of Science and Technology Innovation Board, and extends the research of R & D whitewashing governance to the level of contract implementation supervision of macro-industrial policy, which is helpful for CSRC to supervise. The second is to explore the mechanism of R & D whitewashing, optimizing the efficiency of organizational operation and information transmission, protecting the rights and interests of investors, promoting the orderly operation of the securities market, etc, which is conducive to the construction of a good and orderly economic and social environment, and is feasible.

2 Theoretical Deduction and Research Hypothesis

Under the registration system, the hard index of company listing is not strict, but it puts forward higher requirements for R & D investment, invention patent output and its actual impact on the company's operating performance, which can reflect the scientific and technological innovation ability of enterprises. Many enterprises in order to achieve Science and Technology Innovation Board listing and obtain policy preferences, so as to carry out R & D whitewashing.

R & D personnel are the main participants in R & D knowledge innovation, and the number of R & D personnel is the key element to measure the R & D ability of enterprises. Through the study of a large number of literature, we find that the investment of R & D personnel needed for R & D activities within the enterprise will promote the enterprise to actively carry out R & D activities and further enhance the technological competitive advantage for the enterprise application department. Guo Chunyan[6]collected macro and micro data, indicating that both R & D funds and R & D personnel investment play a significant positive role in innovation achievements. Yang Ziwei[4] pointed out that companies on the KTC board can obtain more funds after listing on the KTC board, expanding financing channels and reducing cash pressure.

The guidelines on the Evaluation of Scientific creation attributes revised by the China Securities Regulatory Commission (CSRC) regard the proportion of R & D personnel as the hard index of IPO in the enterprise application department. Because the current evaluation index system of scientific research and development attributes does not clearly define the concept of R & D personnel, some scientific and technological enterprises will make use of the loopholes of this current system to increase the number of R &D personnel by increasing non-substantive R & D personnel, packaging the R & D team of enterprises, and because of the existence of asymmetric information, it is difficult to be effectively identified by outsiders. The following hypothesis is therefore put forward:

H: there is a positive relationship between R & D input and whitening behavior of R & D investment

3 Research and Design

3.1 Data Sources

This project takes all the companies that have completed the listing audit since Science and Technology Innovation Board's listing to June 31, 2022 as the initial research samples, collects the data of the latest version of the company's IPO published on the company's creation registration system audit website (excluding the interim report), and obtains a database to study the motivation of enterprise R & D manipulation and whitewashing behavior.

The research data are as follows:

(1) according to the research of Yang Guochao [3], the samples with operating income less than 50 million yuan are eliminated. (2) Divide the sample into two parts according to successful listing and unsuccessful listing. (3) All continuous variables are tailed at 1% quartile to eliminate the effects of extreme and abnormal values. (4) Eliminate missing sample values. After the processing and test of the sample data of this project, the remaining 676 samples were eliminated, of which 469 were successfully listed and 207 were failed.

3.2 Research Methods

(1) Model Design. Drawing on Wang Lanfang and others.[7]

$$OverRD_{i,t+1}=\alpha_0+\alpha_1 DL+SigmaControls_{i,t}+\alpha_2 Age+ _{i,t+1} \quad (1)$$

(2) Variable Measurement.

a) Research and Development Whitewash Behavior.

The measurement of R & D "whitewash" behavior draws lessons from the method of Gunny[9], and estimates the normal value of R & D expenses / operating income by regression of each industry in one year. There is a difference between the actual value and the normal value of R & D expenses / operating income. If the actual value is larger than the normal value, the behavior of R & D whitewashing is more likely. This project assumes that the enterprise with the difference greater than the average sample has R & D whitewashing behavior, OverRD is 1, otherwise it is 0. The estimated model of the normal value of R & D expenses / operating income is as follows:

$$\frac{RD_{i,t}}{Sales_{i,t}} = \alpha_0 + \alpha_1 \frac{1}{Sales_{i,t}} \frac{INT_{i,t}}{Sales_{i,t}} + \alpha_2 + \alpha_3 + \frac{RD_{i,t-1}}{Sales_{i,t}} i,t \quad (2)$$

Among them, RD/Sales represents R & D expenditure / operating income, INT/Sales represents (net profit + depreciation) / operating income.

b) Research and Development Investment Intensity DL.

Science and Technology Innovation Board listing can bring policy preferences to high-tech enterprises, while Science and Technology Innovation Board listing has strict standards for R & D investment, which provides an incentive for enterprises to list through whitewashing behavior. Variable DL measures the investment in R & D di-

rection and reflects the degree of demand for listing to a certain extent. Specify the number of R & D personnel / total number of employees in DL.

c) Control Variable.

Controls is a set of control variables that include: (1) Age represents company age. (2) Size represents the size of the company, measured by the natural logarithm of the total assets. (3) LEV represents leverage, measured by total liabilities divided by total assets. (4) ROA represents the rate of return on total assets, measured by net profit divided by total assets. (5) CFO indicates operating cash flow, measured by net operating cash flow divided by total assets. (6) SOE is a virtual variable, indicating the nature of property rights. The value of state-owned enterprises is 1, and the value of non-state-owned enterprises is 0. (7) Loss is a virtual variable, indicating loss, the total profit is negative value of 1, positive value of 0.

4 Empirical Results and Analysis

4.1 Descriptive Statistics

Table 1. Descriptive statistics of variables

	Sample size	Mean value	Variance	Minimum value	Maximum value
OverRD	676	0.355	0.479	0	1
DL	676	0.309	0.196	0.0114	1
YEAR	676	2.835	0.327	1.946	3.761
SIZE	676	20.55	1.181	17.63	25.47
LEV	676	0.408	0.282	0.0428	3.184
ROA	676	0.0805	0.198	-2.748	0.686
COF	676	0.121	1.183	-13.94	24.34
SOE	676	0.0799	0.271	0	1
LOSS	676	0.0991	0.299	0	1

From the descriptive statistics in Table 1, we can see that the average value of whitewashing behavior is 0.335, indicating that 35.5% of the companies applying for gem listing have R & D whitewashing behavior, which is a high proportion. The maximum value of DL is 100% and the minimum value is 1.14%. The proportion of R & D personnel in different enterprises varies greatly.

4.2 Correlation Analysis

Table 2. Correlation analysis and test

	OverRD	DL	YEAR	SIZE	LEV	ROA
OverRD	1					
DL	0.280 *	1				

YEAR	-0.140 *	-0.252 *	1			
SIZE	0.308 *	-0.182 *	0.0250	1		
LEV	0.141 *	-0.074 *	-0.0320	0.289 / *	1	
ROA	-0.25 / 5 *	-0.101 *	0.135 *	-0.144 *	-0.521 *	1
COF	-0.0390	-0.065 *	0.0310	-0.00200	0.00600	0.147 *
SOE	0.0440	-0.104 *	0.156 *	0.223 / *	0.119 *	-0.0260
LOSS	0.313 *	0.260 *	-0.198 / *	0.0250	0.223 / *	-0.577 *

Note: * p < 0.01, * * p < 0.05, * p < 0.1

From the results of correlation analysis in Table 2, it can be seen that the correlation coefficient between the explanatory variable DL and the explained variable OverRD is significantly positive, indicating that there is a significant positive correlation between R & D investment intensity and R & D whitewashing, which preliminarily proves the previous corollary. In this paper, the collinearity is tested by variance expansion coefficient (VIF). It is found that the average value of VIF between variables is less than 5, so there is no multiple collinearity problem between variables.

4.3 Regression Result

Table 3. Regression test results

	(1)	(2)
VARIABLES	OverRD	OverRD
DL	0.006 *	0.007 *
	(6.87)	(7.74)
SIZE		0.141 *
		(9.69)
LEV		-0.046
		(- 0.66)
ROA		-0.192 *
		(- 1.69)
COF		0.005
		(0.34)
SOE		0.023
		(0.37)
LOSS		0.300 *
		(4.43)
Constant	0.465 *	-2.614 *
	(2.75)	(- 7.68)
YEAR	YES	YES
Observations	676	676
R-squared	0.084	0.265
F	30.78	30.09

Note: * p < 0.01, * * p < 0.05, * p < 0.1

Table 3 shows the regression results of the proportion of R & D personnel in R & D whitewashing behavior. In column (1)of regression that only controls annual and industry effects, the regression coefficients of DL are significantly positive at the level of 1%. After adding other control variables to column (2), the regression coefficient of DL is also significantly positive at the level of 1%. It shows that the proportion of high R & D personnel in enterprises often indicates the research and development whitewash behavior. R & D personnel are the main participants in R & D knowledge innovation, and the number of R & D personnel is the key element to measure the R & D ability of enterprises. Because the current evaluation index system of R & D attributes does not clearly define the concept of R & D personnel, some scientific and technological enterprises will take advantage of the loopholes in this current system to increase the number of R & D personnel by increasing non-substantive R & D personnel, and package the R & D teams of enterprises Therefore, the more R & D personnel, the greater the probability of R & D whitewashing, and the hypothesis in this paper has been verified.

4.4 Robust Test

In order to ensure the robustness of the results, this paper also does the following tests, the main results are still consistent with expectations: (1) The data used in this paper are all the companies that completed the listing audit from the listing of Science and Technology Innovation Board to June 31, 2022 as the initial research samples. With the time, the sample capacity was expanded to all the companies that completed the listing audit from the listing of the company to December 31, 2023. The empirical results remain unchanged. (2) Reference to Liu Jianhe's approach, measuring the intensity of replacement R & D investment. The ratio of R & D investment / sales income is used to measure the intensity of R & D investment instead of the proportion of R & D personnel, and the empirical conclusion remains unchanged.[8]

5 Conclusions and Suggestions

Taking all the companies that completed the listing audit from Science and Technology Innovation Board's listing to 2022 as the initial research samples, this paper explores whether there is "R & D whitewashing" behavior before the listing of the listed companies on the gem, and empirically analyzes the influence of R & D investment intensity on R & D whitewashing. Research shows that, first, there is a high proportion of companies that apply for gem listing have R & D whitewashing behavior. Second, there is a significant correlation between the proportion of R & D investment personnel and R & D whitewashing behavior. Many scientific innovation enterprises will make use of the loopholes in the current R & D attribute evaluation index system that do not clearly define the concept of R & D personnel to falsely increase the number of R & D personnel.

Based on the above conclusions and analysis, the following suggestions are put forward:

First, improve the index evaluation system and strengthen the substantive audit. For the R & D intensity, the number of R & D personnel and other key indicators to measure enterprise innovation research, we should clearly explain the definition, make a clear and scientific definition, such as for different scales, different industries in what range of indicators is reasonable. In addition, it is necessary to strengthen the substantive investigation and carry out dynamic evaluation to prevent the surprise operation and speculative behavior of enterprises.

Second, make full use of digital technology, multi-party co-audit, strengthen the disclosure and examination of enterprise information. With the help of the advantages brought by the development of digital economy, big data, block chain and other technologies have been widely used to effectively improve the ability to capture, integrate, transmit and apply disclosure information, and to play a supervisory role in enterprises. In addition to using technical means to strengthen supervision, more subjects could also be included to participate in the verification. At present, the third party review of disclosure information by market institutions is insufficient, and still rely on the regulatory authorities to review the listing application information. Investment agencies believe that the relevant information that the regulatory authorities have reviewed the meeting is credible and of high quality. This does not give full play to the supervision role of the third party in the market, so it is necessary to make the disclosure of information more open and transparent, protect the right to know and participate in the market institutions, and encourage all sectors of society and stakeholders to participate in the verification of the information.

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